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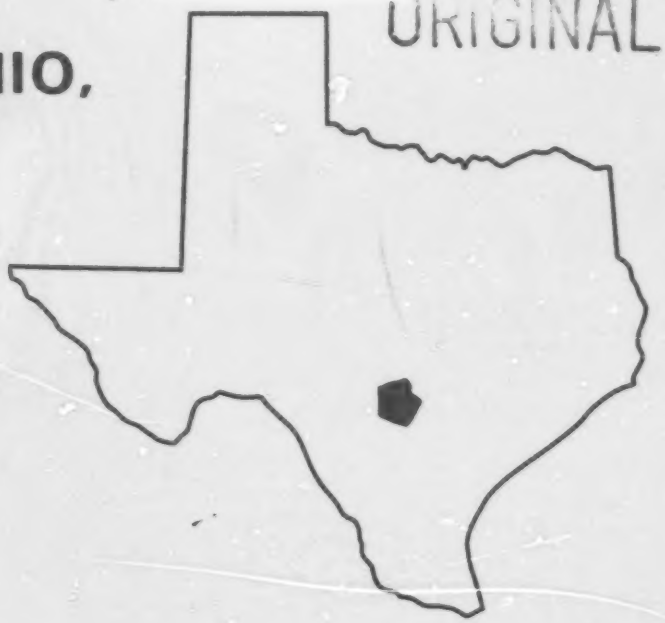
FLOOD INSURANCE STUDY

295

ORIGINAL

CITY OF SAN ANTONIO, TEXAS
BEXAR COUNTY



APRIL 2, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 480045

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FLOOD INSURANCE STUDY
CITY OF SAN ANTONIO, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of San Antonio, Bexar County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses by the U. S. Geological Survey (USGS), Water Resources Division, Austin, Texas, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 13. This work, which was completed in July 1979, was revised in March 1982 by Bernard Johnson, Inc., to incorporate changes requested by the City of San Antonio. In addition, in November 1984, the hydrologic and hydraulic analyses for portions of Leon Creek and Huebner Creek - Tributary A were revised by Pape-Dawson Engineers due to channelizations. This revision incorporates updated hydrologic and hydraulic methodologies for Salado Creek based on the flood retention effects of eleven dams recently constructed by the Soil Conservation Service (SCS) in the Salado Creek watershed. This work was completed in January 1985.

1.3 Coordination

Regional drainage area-frequency discharge relationships used in this study were coordinated by the USGS with those used in studies of nearby

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areas by the U. S. Army Corps of Engineers (COE), the Soil Conservation Service (SCS), and the San Antonio River Authority. An announcement of this study was made by a legal notice in the local newspaper The San Antonio Express, which is published for distribution in San Antonio and other nearby communities.

The initial time and cost meeting, which included officials of the City of San Antonio and the USGS (the study contractor), was held on January 30, 1976. At this and subsequent informal meetings, such items as local flooding problems, available community maps, and available hydrologic data computed and compiled by the City Engineering Department were discussed. The elevation reference marks used in the ground surveys of the cross sections were established by the U. S. Coast and Geodetic Survey and United Aerial Mapping Company, Inc.

A final Consultation and Coordination Officer's (CCO) meeting was held on December 9, 1980, to review the study with representatives of the USGS, FEMA, and officials of the City of San Antonio.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of San Antonio, Bexar County, Texas. Not included in this study are the Cities of Castle Hills, Balcones Heights, Alamo Heights, Terrell Hills, and Olmos Park, which are located within the boundaries of San Antonio. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods within the community: the San Antonio River, Olmos Creek, Sixmile Creek, South Flores Tributary - Sixmile Creek, Commercial Tributary - Sixmile Creek, State Hospital Creek, San Pedro Creek, Apache Creek, Zarzamora Creek, Alzan Creek, Martinez Creek, Bandera Branch, Upper Apache Creek, Zarzamora Creek - Tributary A, Airport Tributary, Airport Tributary - Tributary A, Rock Creek, West Fork of Olmos Creek, Salado Creek, Tributary A to Salado Creek, Tributary B to Salado Creek, Tributary C to Salado Creek, Fort Sam Houston Tributary to Salado Creek, Walzem Creek, Beitel Creek, Beitel Creek - Tributary A, Quail Creek, Tributary D to Salado Creek, Tributary E to Salado Creek, Tributary F to Salado Creek, Mud Creek, Lorence Creek, U. S. 281 Tributary to Salado Creek, Leon Creek, Westwood Village Creek, Southwest Research Creek, Culebra Creek, Huebner Creek, Huebner Creek - Tributary A, Huebner Creek - Tributary B, French Creek, French Creek - Tributary A, French Creek - Tributary B, Huesta Creek, Babcock Tributary - Leon Creek, U.T.S.A. Tributary - Leon Creek, Martinez Creek - Bexar County, and Indian Creek. In a previous

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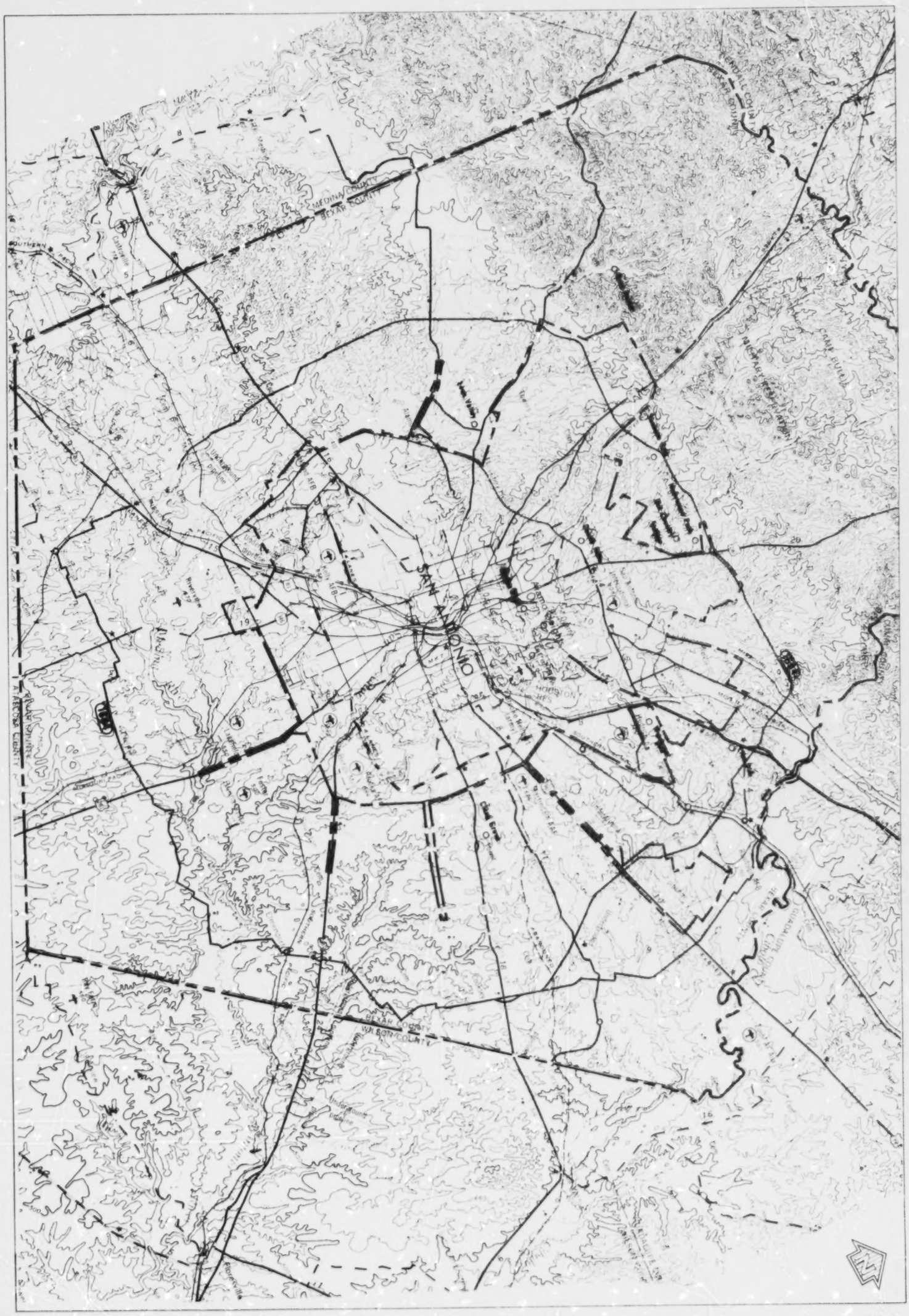

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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revision, Leon Creek was revised from Ingram Road to Culebra Road to incorporate stream channelizations; Huebner Creek - Tributary A was revised from approximately 1,400 feet above the confluence with Huebner Creek (station 1400) to approximately 2,600 feet above the confluence with Huebner Creek (station 2600) to incorporate stream channelizations and the addition of Eckert Boulevard bridge. In this study, the hydrologic and hydraulic analyses for Salado Creek were revised for its entire length within the community to incorporate the flood retention effects of eleven dams constructed in upstream portions of the Salado Creek watershed. In addition, backwater elevations on Tributaries A, B, C, D, E, and F to Salado Creek, Fort Sam Houston Tributary to Salado Creek, Walzem Creek, Beitel Creek, Quail Creek, Mud Creek, Lorence Creek, and U. S. 281 Tributary to Salado Creek were revised to reflect the new elevations on Salado Creek. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

2.2 Community Description

The City of San Antonio is located in the south central portion of Texas and includes approximately half of Bexar County. San Antonio completely surrounds 5 smaller communities: Castle Hills, Balcones Heights, Alamo Heights, Terrell Hills, and Olmos Park. The 1970 population of San Antonio was 773,248 (References 1 and 2).

A continuous settlement has existed on the location that is now San Antonio since the explorer La Salle claimed the area for France in 1685. The French claim existed until 1836 when Texas became a republic following the Texas Revolution in which the battle of the Alamo, located in San Antonio, was fought. San Antonio was incorporated in 1837 by the Republic of Texas (Reference 2). Most of the area within the City of San Antonio is highly diversified with all of the assets and problems that can be found in all other cities of comparable size, population, and longevity of existence. Most of the areas to the west, north, and east of the city are under intense developmental pressure and will continue to be in the foreseeable future.

All of the three major drainages in San Antonio flow generally from the north to the south and merge with the San Antonio River a few miles south of the southern corporate limits of the city. The three major drainage systems are: (1) Salado Creek and its 14 tributaries that drain most of the eastern third of the city; (2) the San Antonio River - Olmos Creek and its 16 tributaries which drain the central part of the city and contain the main business area of the city; and (3) Leon Creek and its 12 tributaries which drain the western part of the city.

The mean annual precipitation for the area is 27.84 inches with extremes of 52.28 inches recorded in 1919 and 10.11 inches in 1917 (References 3

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and 4). The climate of San Antonio is dry subtropical with mild winters and hot summers. The mean annual temperature is 68.7 degrees Fahrenheit (°F), with a range from over 100°F in the summer to occasional lows of below 30°F in the winter (References 3 and 4).

San Antonio is located on the Balcones Fault Zone, which is the transitional area between the Edwards Plateau and the Gulf Coastal Plains. The terrain varies from rather steep limestone outcroppings to broad flat blackland soil cover (Reference 5 and 6).

2.3 Principal Flood Problems

Prevailing south winds in the area cause thunderstorms to occur frequently in the spring and summer. Long duration, low intensity storms triggered by southward moving continental polar fronts occur during the fall and winter. Some of the heaviest rainfall occurs in late summer and early fall as a result of hurricanes moving inland from the Gulf of Mexico. Individual storms that cause serious flooding may occur during any season, but they are most frequent in the spring. The normal rainfall for San Antonio, based on records of the National Weather Service for the period 1931 to 1960, is 27.84 inches, with the largest average monthly rainfall occurring in May, June, and September (References 3 and 4).

2.4 Flood Protection Measures

The SCS has developed flood protection measures in the Salado Creek Basin. This includes 16 floodwater retarding structures on tributaries in the upper reaches of the basin. These structures will lessen the effects of floodwaters downstream for a considerable distance until intervening drainage areas decrease their effectiveness (Reference 7).

The name of the San Antonio River changes to Olmos Creek in the vicinity of the Hildebrand Avenue crossing, which is a short distance downstream from Olmos Dam. For convenience and continuity in this report, the name change will occur at Olmos Dam. The Olmos Dam was built during 1925 to 1929 to serve as a detention structure to lessen the severity of flooding throughout the downtown business district of the city after it was devastated by the flood of September 9, 1921 (Reference 8). Figures 2, 3, 4, and 5 show flood photographs on the San Antonio River during the flood of September 9, 1921.

The Leon Creek drainage basin is almost entirely in its natural state with little or no known flood protection measures at this time. An overflow channel does break out of Leon Creek just upstream of West Haursman Road and rejoins Leon Creek just downstream of West Prue Road. The overflow channnel is considered to be in the same flood plain with Leon Creek and, therefore, was modeled as one reach.

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FIGURE 2: San Antonio River at St. Mary's Street

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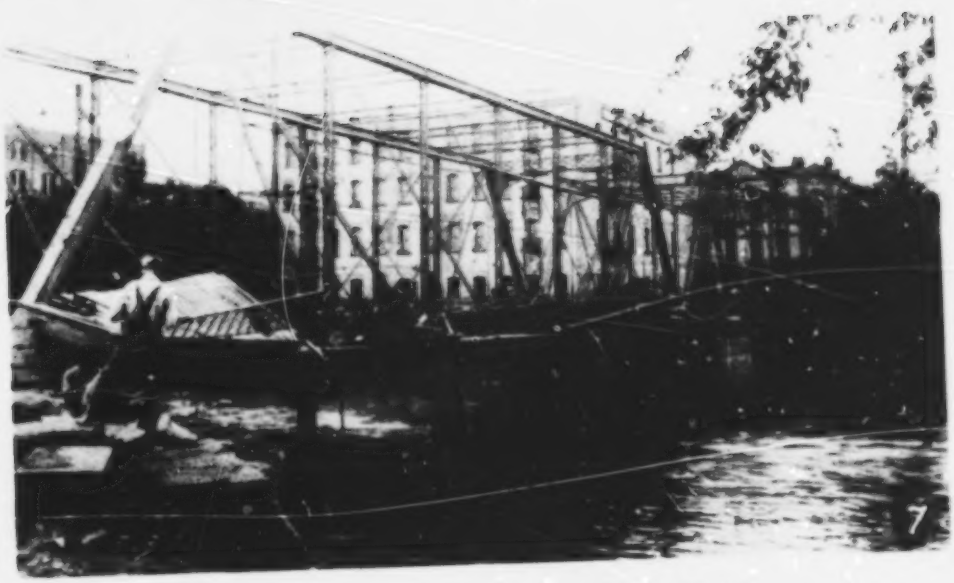

FIGURE 3: San Antonio River at Navarro Street.

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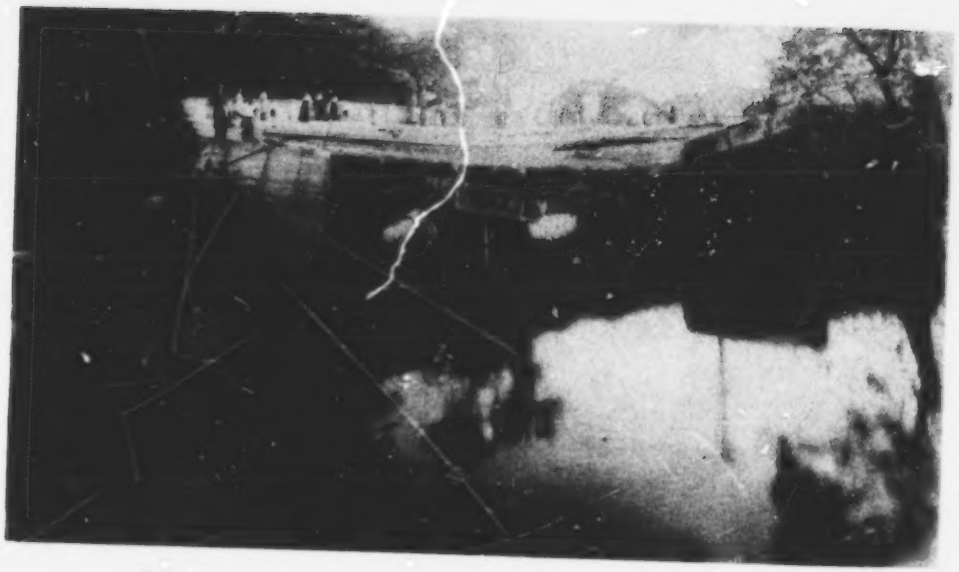

FIGURE 4: San Antonio River at South Alamo Street

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FIGURE 5: Alazan Creek at Missouri Pacific Railroad

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This study incorporates the flood retention effects of dams 1, 2, 4, 5, 6, 8, 9, 11, 12, 13A, and 13B that were recently constructed by the SCS in the Salado Creek watershed. These structures have been designed to retain the 100-year floodwater runoff from a combined 47,852 acres of the watershed.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The City of San Antonio furnished discharge-drainage area design curves for the 100-year frequency flood for the San Antonio River, Salado Creek, Leon Creek, and Culebra Creek. The 10-, 50-, and 500-year fequency curves were plotted parallel to the 100-year frequency curve.

The remainder of the streams studied by detailed methods in the City of San Antonio utilized flood fequency curves prepared by using the results of multiple regression analysis for Region V to flood characteristics in the San Antonio area (Reference 9); discharge data for area streams (References 10, 11, 12, and 13); data from COE Flood Plain Information Studies of area streams (References 14, 15, 16, 17, 18, 19, 20, 21, and 22); SCS Work Plans (References 7 and 23); Flood Hazard Analyses for Helotes Creek (Reference 24), and a soil survey for Bexar County (Reference 5).

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This revision incorporates an updated hydrologic analysis for Salado Creek. This analysis was based on the flood retention effects of eleven dams recently constructed by the SCS in the Salado Creek watershed. Discharges were obtained from application of unit hydrograph methodologies to analyze runoff from uncontrolled portions of the Salado Creek watershed. An adjustment was then made to account for principal spillway discharges at the dam sites.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges." The City of San Antonio Engineering Department furnished the 100-year flood discharges that were used specifically between South Alamo Street and Olmos Dam on the San Antonio River.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SAN ANTONIO RIVER					
Upstream of Ashley Road	75.6	11,000	30,000	45,000	96,000
Downstream of Theo Street	52.6	8,400	23,500	36,000	73,000
Downstream of Missouri-Kansas-Texas Railroad	10.1	2,860	8,200	14,300	25,000
Downstream of Villita Street	9.7	2,800	8,000	14,200	24,300
Upstream of Newell Street	7.6	2,400	6,900	10,400	21,300
Downstream of Hildebrand Avenue	3.4	1,300	3,750	6,100	11,600
OLMOS CREEK					
Upstream of Missouri-Pacific Railroad	31.00	5,300	14,500	21,600	45,000
At Jackson-Keller Road	17.60	4,100	11,500	17,975	37,100
Upstream of Dreamland Drive	13.40	3,560	9,870	14,310	29,650
Upstream of George Road	7.40	2,350	6,870	9,800	20,500
SIXMILE CREEK					
Downstream of Espado Road Extended	15.20	3,800	10,500	15,400	31,300
Downstream of Bascum Boulevard	10.40	3,050	8,600	12,300	25,300
Downstream of Commercial Boulevard	6.00	2,000	5,820	8,500	18,000
Downstream of Zarzamora Street	3.30	1,270	3,580	5,380	11,300

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
SOUTH FLORES TRIBUTARY - SIXMILE CREEK					
Upstream of mouth	3.40	1,300	3,750	5,650	[illegible],900
COMMERCIAL TRIBUTARY - SIXMILE CREEK					
Downstream of Ansley Street	2.40	1,000	2,900	4,300	9,100
Downstream of Hutchins Street	1.80	800	2,320	3,450	7,200
STATE HOSPITAL CREEK					
Upstream of mouth	2.06	900	2,600	3,820	8,100
Downstream of South New Braunfels Street	1.29	630	1,820	2,660	5,550
SAN PEDRO CREEK					
Downstream of Probandt Street	42.6	6,020	16,800	25,000	52,500
Downstream of South Alamo Street	2.70	1,100	3,150	4,700	10,000
Upstream of West Commerce Street	2.10	900	2,600	3,850	8,200
Upstream of Arbor Street	1.60	730	2,120	3,120	6,600
At Evergreen Street	1.00	540	1,550	2,270	4,720
APACHE CREEK					
Downstream of Misscuri Pacific Railroad	20.90	4,460	12,100	18,200	27,100
Downstream of South Zarzamora Street	19.60	4,320	13,300	17,600	36,000
Downstream of Elmendorf Dam	18.40	4,200	11,400	17,000	34,600
ZARZAMORA CREEK					
Downstream of M. San Joaquin	13.00	3,500	9,700	14,100	28,600
Upstream of Azucena Stett	12.10	3,350	9,300	13,500	27,500
Upstream of Babcock Road	1.10	560	1,600	2,320	4,820
ALAZAN CREEK					
Downstream of Tampico Street	18.10	4,200	11,300	17,000	34,500

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ALAZAN CREEK - continued					
Downstream of Poplar Street	8.56	2,650	7,600	10,800	22,500
Downstream of St. Cloud Street	3.30	1,270	3,680	5,500	11,600
MARTINEZ CREEK					
Downstream of Ruiz Street	7.70	2,430	7,000	10,000	21,000
Upstream of Fredricksburg Road	6.40	2,100	6,100	8,800	18,700
Downstream of Fresno Street	2.80	1,120	3,220	4,820	11,200
BANDERA BRANCH					
Upstream of Southwest 26th Street	1.30	630	1,820	2,670	5,600
Downstream of Ruiz Street	1.07	540	1,550	2,280	4,750
UPPER APACHE CREEK					
Upstream of Martin Street	2.40	1,000	2,900	4,300	9,000
Upstream of Cornelia Avenue	1.80	800	2,320	3,420	7,220
ZARZAMORA CREEK - TRIBUTARY A					
Downstream of Majestic Road	2.84	1,130	3,300	4,900	10,300
Downstream of Evers Road	2.32	980	2,850	4,200	8,800
AIRPORT TRIBUTARY					
Approximately 125 feet upstream of mouth	6.50	2,150	6,100	8,900	18,800
Downstream of Maltzberger Road	3.00	1,180	3,700	5,150	10,800
Downstream of Sunset Road	2.30	970	2,900	4,150	8,800
AIRPORT TRIBUTARY - TRIBUTARY A					
Approximately 700 feet upstream of mouth	2.82	1,130	3,260	4,900	10,400

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ROCK CREEK					
Downstream of Vance-Jackson Road	3.23	1,250	3,620	5,450	11,500
Upstream of Callaghan Road	2.46	1,020	2,950	4,400	9,300
WEST FORK OLMOS CREEK					
Upstream of Wurzback Road	4.62	1,650	4,700	7,100	14,800
Downstream of Southern Pacific Railroad	4.33	1,570	4,500	6,750	14,200
Upstream of Huebner Road	2.94	1.170	3,380	5,050	10,600
At De Zavala Road	1.30	1,100	2,880	3,300	4,040
SALADO CREEK					
Upstream of Loop 13	190.4/115.6*	36,900	54,300	61,000	170,000
Upstream of confluence of Beitel Creek	145.0/70.2*	31,700	46,500	52,000	140,000
Upstream of Nacogdoches Road	131.5/56.7*	28,600	41,600	46,600	130,000
Upstream of confluence of Mud Creek	66.8/30.6*	16,700	24,000	27,000	81,000
Downstream of West Avenue	35.5/18.5*	12,200	17,300	19,300	58,000
TRIBUTARY A TO SALADO CREEK					
Approximately 1,575 feet upstream of mouth	1.30	630	1,820	2,650	5,550
TRIBUTARY B TO SALADO CREEK					
Approximately 1,890 feet downstream of Artesia Avenue	2.10	910	2,620	3,900	8,200
Downstream of Interstate Route 35	1.64	750	2,170	3,200	6,700
TRIBUTARY C TO SALADO CREEK					
Approximately 500 feet downstream of Coliseum Road	3.20	1,250	3,600	5,400	11,300
Approximately 800 feet downstream of Monson Road	2.00	870	2,520	3,750	7,900

*Drainage area reflects areas uncontrolled by flood retention structures

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
FORT SAM HOUSTON TRIBUTARY TO SALADO CREEK					
Approximately 50 feet upstream of W. W. White Road	2.40	1,000	2,900	4,300	9,000
WALZEM CREEK					
At Bikini Drive	2.22	950	2,750	4,050	8,600
At Dell Oak	1.84	820	2,360	3,500	7,300
Approximately 1,300 feet upstream of Overland	1.00	520	1,500	2,160	4,500
BEITEL CREEK					
Approximately 550 feet downstream of Perrin Beitel Drive	14.9	3,800	10,300	15,200	31,000
Approximately 1,000 feet upstream of confluence of Beitel Creek Tributary A	11.3	3,220	9,000	13,000	26,500
BEITEL CREEK - TRIBUTARY A					
Approximately 450 feet upstream of confluence with Beitel Creek	1.20	590	1,700	2,500	5,200
QUAIL CREEK					
Approximately 1,200 feet upstream of Interstate Route 410	0.96	500	1,450	2,100	6,900
TRIBUTARY D TO SALADO CREEK					
At Vandiver Road	2.92	1,260	3,380	5,050	10,600
TRIBUTARY E TO SALADO CREEK					
At Missouri-Kansas-Texas Railroad	1.28	620	1,800	2,620	5,500
TRIBUTARY F TO SALADO CREEK					
At Nacogdoches Road	5.20	1,800	5,200	7,700	16,200

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MUD CREEK					
At Star Crest Drive	57.2	6,800	19,200	28,300	60,000
Approximately 250 feet downstream of Jones-Maltzburger Road	17.2	4,100	11,000	16,500	33,500
LORENCE CREEK					
At Buckhorn Road	7.60	2,400	7,000	10,000	21,000
At Shadow Road	4.60	1,640	4,700	7,000	14,800
Approximately 150 feet upstream of San Pedro - U. S. Route 281	3.30	1,270	3,700	5,550	11,600
U. S. 281 TRIBUTARY TO SALADO CREEK					
Approximately 100 feet downstream of Maltzburger Road	1.80	800	2,320	3,450	7,200
LEON CREEK					
Approximately 3,600 feet upstream of Castroville Highway	198.0	20,500	56,000	80,000	172,000
Approximately 900 feet upstream of Culebra Creek	77.0	11,000	31,000	46,000	96,500
Approximately 650 feet downstream of Hausman Road	44.0	7,600	21,000	32,000	66,000
WESTWOOD VILLAGE CREEK					
Approximately 200 feet downstream of U. S. Route 90	1.65	760	2,150	3,200	6,800
SOUTHWEST RESEARCH CREEK					
Approximately 1,300 feet above mouth	11.3	3,220	9,000	13,000	26,500
CULEBRA CREEK					
Approximately 18,100 feet above mouth	75.8	10,500	30,000	42,000	91,000

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HUEBNER CREEK					
Approximately 200 feet downstream of Bandera Creek	8.98	2,750	7,900	11,200	23,000
Approximately 650 feet upstream of Huebner Road	4.21	1,550	4,440	6,600	14,000
At Prue Road	2.50	1,030	3,000	4,450	9,000
HUEBNER CREEK - TRIBUTARY A					
Approximately 350 feet above mouth	2.50	1,030	3,000	4,450	9,000
HUEBNER CREEK - TRIBUTARY B					
Approximately 800 feet above mouth	1.25	620	1,750	2,600	5,500
FRENCH CREEK					
Approximately 350 feet downstream of FM 1604	2.23	950	3,750	4,100	8,600
FRENCH CREEK - TRIBUTARY A					
Approximately 4,000 feet above mouth	1.20	590	1,700	2,500	5,200
FRENCH CREEK - TRIBUTARY B					
Approximately 350 feet downstream of FM 1604	1.20	590	1,700	2,500	5,200
HUESTA CREEK					
Approximately 250 feet downstream of Babcock Road	5.83	1,950	5,700	8,300	17,500
BABCOCK TRIBUTARY - LEON CREEK					
Approximately 300 feet downstream of Babcock Road	4.86	1,700	4,900	7,400	15,500
U.T.S.A. - LEON CREEK					
Approximately 100 feet downstream of U.T.S.A. Boulevard	1.20	590	1,700	2,500	5,200

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
MARTINEZ CREEK - BEXAR COUNTY					
At cross section H	8.90	2,320	6,250	8,200	19,200
INDIAN CREEK					
At Interstate Route 410	5.90	1,975	5,750	8,400	17,500

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Base maps and cross section data for streams in the area were obtained from aerial photographs (Reference 25). All bridges and culverts were field surveyed to obtain elevation data and structural geometry. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Along certain portions of Salado Creek, a profile base line is shown on the maps to represent channel distances as indicated on the flood profiles and floodway data tables.

Roughness coefficients (Manning's "n") were estimated by field inspection and from photographs. The City of San Antonio provided information concerning channel revisions and hydraulic structure revisions which were incorporated into the study.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USGS step-backwater E431 computer program and the updated J-635 model (Reference 26). The water-surface elevations of floods for the selected recurrence intervals for the revised portions of Leon Creek and Huebner Creek - Tributary A were computed using the COE HEC-2 step-backwater computer program (Reference 27). Starting water-surface elevations for the streams studied by detailed methods were determined by normal depth. Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Flooding information including insurance zones and base flood elevations for West Fork Olmos, Culebra, and Indian Creeks was incorporated into this study from the Flood Insurance Study for the unincorporated areas of Bexar County (Reference 28).

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

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The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 25).

Flood boundaries for West Fork Olmos, Culebra, and Indian Creeks were delineated using the Flood Insurance Study for the unincorporated areas of Bexar County (Reference 28).

The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Officials of the City of San Antonio requested a zero surcharge on all streams in the city; therefore, floodways were not included in this study.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the

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determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the City of San Antonio.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of San Antonio are shown on the Flood Profiles (Exhibit 1) and summarized in Table 2.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
San Antonio River							
Reach 1	0030,0039 0045,0051, 0057,0058	-8.0	-3.0	+5.7	080	A16	Varies
Reach 2	0030	-3.9	-1.3	+1.8	040	A8	Varies
Olmos Creek							
Reach 1	0022,0030	-8.2	-2.7	+9.3	080	A16	726.13
Reach 2	0021,0022	-6.9	-2.6	+6.8	070	A14	Varies
Reach 3	0008,0015, 0021	-4.2	-1.4	+3.1	040	A8	Varies
Sixmile Creek							
Reach 1	0056,0057	-7.7	-2.4	+5.0	075	A15	Varies
Reach 2	0050,0056	-4.5	-1.4	+2.3	045	A9	Varies
Reach 3	0050	-6.9	-0.9	+2.4	070	A14	Varies
South Flores Tributary-Sixmile Creek							
Reach 1	0051,0057	-6.0	-2.2	+3.2	060	A12	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

SAN ANTONIO RIVER-OLMOS CREEK-SIXMILE CREEK-SOUTH FLORES TRIBUTARY-SIXMILE CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND 10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
Commercial Tributary-Sixmile Creek							
Reach 1	0050,0056	-3.0	-0.8	+2.2	030	A6	Varies
Reach 2	0050	-5.5	-0.7	+2.0	055	A11	Varies
Reach 3	0050	-4.3	-0.7	+2.1	045	A9	Varies
State Hospital Creek							
Reach 1	0051	-3.2	-1.1	+6.7	030	A6	Varies
Reach 2	0051	-2.0	-0.7	+1.6	020	A4	Varies
San Pedro Creek	0038						
Reach 1	0044,0045	-7.8	-2.7	+6.8	080	A16	Varies
Reach 2	0038,0039	-7.2	-2.4	+5.8	070	A14	Varies
Reach 3	0030,0039	-3.9	-0.9	+3.0	040	A8	Varies
Apache Creek							
Reach 1	0038	-8.2	-2.8	+7.1	080	A16	Varies
Reach 2	0038	-0.9	-0.6	+5.9	010	A2	Varies
Reach 3	0038	-3.8	-0.9	+3.1	040	A8	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

COMMERCIAL TRIBUTARY SIXMILE CREEK – STATE HOSPITAL CREEK – SAN PEDRO CREEK – APACHE CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Zarzamora Creek	0028,0037,						
Reach 1	0038	-6.8	-2.5	+6.1	070	A14	Varies
Reach 2	0028,0037	-3.4	-1.0	+2.4	035	A7	Varies
Reach 3	0014,0020, 0028	-2.2	-0.7	+1.7	020	A4	Varies
Alazan Creek							
Reach 1	0029,0038	-6.6	-2.3	+4.8	065	A13	Varies
Reach 2	0029	-5.9	-1.9	+2.8	060	A12	Varies
Martinez Creek							
Reach 1	0021,0029, 0038	-4.8	-1.6	+3.4	050	A10	Varies
Bandera Branch							
Reach 1	0029,0038	-4.1	-1.2	+2.5	040	A8	Varies
Upper Apache Creek							
Reach 1	0028,0029, 0038	-4.2	-1.6	+3.2	040	A8	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

ZARZAMORA CREEK – ALAZAN CREEK – MARTINEZ CREEK – BANDERA BRANCH – UPPER APACHE CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Tributary A-Zarzamora Creek							
Reach 1	0020, 0028	-3.0	-1.2	+1.4	030	A6	Varies
Airport Tributary							
Reach 1	0022	-8.2	-3.2	+8.3	080	A16	Varies
Reach 2	0016, 0022	-2.5	-0.7	+1.8	025	A5	Varies
Tributary A-Airport Tributary							
Reach 1	0022	-5.1	-2.0	+3.8	050	A10	Varies
Rock Creek							
Reach 1	0015	-2.6	-0.5	+2.1	025	A5	Varies
West Fork Olmos Creek							
Reach 1	0008, 0015	-2.7	-0.9	+2.1	025	A5	Varies
Reach 2	0007, 0008	-0.8	-0.3	+0.5	010	A2	Varies

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

TRIBUTARY A ZARZAMORA CREEK – AIRPORT TRIBUTARY – TRIBUTARY A – AIRPORT TRIBUTARY – ROCK CREEK – WEST FORK OLMOS CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Salado Creek Reach 1	08,09,10, 16,17,23, 31,32,40, 46,52,58	-3.7	-0.9	+8.8	035	A7	Varies
Tributary A to Salado Creek Reach 1	46	-2.4	-0.7	+1.7	025	A5	Varies
Tributary B to Salado Creek Reach 1	46	-3.9	-1.9	+2.2	040	A8	Varies
Tributary C to Salado Creek Reach 1	40	-3.9	-1.1	+2.4	040	A8	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

SALADO CREEK - TRIBUTARY A TO SALADO CREEK - TRIBUTARY B TO SALADO CREEK - TRIBUTARY C TO SALADO CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Fort Sam Houston Tributary to Salado Creek							
Reach 1	31	-2.6	-0.7	+1.3	025	A5	Varies
Walzem Creek							
Reach 1	23	-6.2	-2.4	+4.9	060	A12	Varies
Reach 2	23	-9.6	-6.5	+3.7	095	A19	Varies
Reach 3	23,24	*	*	+1.9	*	AH	Varies
Reach 4	24	-2.3	-0.8	+1.5	025	A5	Varies
Beitel Creek							
Reach 1	23,24	-4.9	-1.8	+3.7	050	A10	Varies
Reach 2	18,24	-7.4	-2.4	+5.0	075	A15	Varies
Reach 3	11,18	-2.8	-0.9	+2.2	030	A6	Varies
Beitel Creek - Tributary A							
Reach 1	18	-2.1	-0.6	+1.4	020	A4	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

*10- and 50-year elevations contained in culvert

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

FORT SAM HOUSTON TRIBUTARY TO SALADO CREEK - WALZEM CREEK - BEITEL CREEK - BEITEL CREEK-TRIBUTARY A

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Quail Creek							
Reach 1	17,23	-3.3	-1.1	+2.2	035	A7	Varies
Tributary D to Salado Creek							
Reach 1	17,23	-4.9	-1.7	+2.8	050	A10	Varies
Reach 2	17,23	-3.6	-1.1	+2.5	035	A7	Varies
Tributary E to Salado Creek							
Reach 1	17	-1.7	-0.6	+1.2	015	A3	Varies
Tributary F to Salado Creek							
Reach 1	17	-3.7	-1.2	+2.4	035	A7	Varies
Mud Creek							
Reach 1	04,10	-4.7	-1.6	+3.6	045	A9	Varies
Lorence Creek							
Reach 1	03,04,10	-3.4	-1.0	+2.5	035	A7	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

QUAIL CREEK - TRIBUTARY D TO SALADO CREEK - TRIBUTARY E TO SALADO CREEK - TRIBUTARY F TO SALADO CREEK - MUD CREEK - LORENCE CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
U. S. 281 Tributary to Salado Creek							
Reach 1	09	-2.3	-0.8	+1.4	025	A5	Varies
Leon Creek							
Reach 1	27,36,37, 42,43,49						
	55	-10.2	-3.2	+7.5	100	A20	Varies
Reach 2	27	-11.8	-2.7	+7.1	120	A22	Varies
Reach 3	02,06,07, 13	-7.0	-2.4	+5.1	070	A14	Varies
Westwood Village Creek							
Reach 1	36	-4.0	-1.3	+3.2	040	A8	Varies
Southwest Research Creek							
Reach 1	36	-9.4	-3.1	+9.6	095	A19	Varies
Reach 2	27,36	-3.8	-1.0	+2.7	040	A8	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

U.S. 281 TRIBUTARY TO SALADO CREEK - LEON CREEK - WESTWOOD VILLAGE CREEK - SOUTHWEST RESEARCH CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Culebra Creek							
Reach 1	19	-8.3	-2.7	+5.1	085	A17	Varies
Huebner Creek							
Reach 1	07, 14	-2.7	-0.8	+2.0	025	A5	Varies
Reach 2	07	-2.1	-0.7	+1.5	020	A4	Varies
Huebner Creek - Tributary A							
Reach 1	14	-2.3	-0.9	+2.1	025	A5	Varies
Reach 2	14	-1.9	-0.6	+1.3	020	A4	Varies
Huebner Creek - Tributary B	14	-1.4	-0.5	+1.2	015	A3	Varies
French Creek							
Reach 1	06	-2.3	-0.4	+1.6	025	A5	Varies
Reach 2	06	-1.8	-0.5	+1.8	020	A4	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

CULEBRA CREEK - HUEBNER CREEK - HUEBNER CREEK-TRIBUTARY A - HUEBNER CREEK-TRIBUTARY B - FRENCH CREEK

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD[3] ELEVATION (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Tributary A - French Creek Reach 1	06	-2.8	-0.4	-0.9	030	A6	Varies
Tributary B - French Creek Reach 1	06	-1.8	-0.5	+1.2	020	A4	Varies
Huesta Creek Reach 1	01,06	-3.2	-0.9	+1.8	030	A6	Varies
Babcock Tributary - Leon Creek Reach 1	01,02,06	-3.5	-1.1	+2.6	035	A7	Varies
U.T.S.A. Tributary - Leon Creek Reach 1	02	-2.5	-0.9	+1.9	025	A5	Varies

[1]Flood Insurance Rate Map Panel
[2]weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

TRIB. A — FRENCH CREEK — TRIB B — FRENCH CREEK — HUESTA CREEK
BABCOCK TRIB. — LEON CREEK — U.T.S.A. TRIB. — LEON CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Martinez Creek - Bexar County							
Reach 1	33	-3.2	-1.1	+2.4	030	A6	Varies
Reach 2	33	-5.1	-1.0	+2.1	050	A10	Varies
Indian Creek							
Reach 1	55	-3.7	-1.1	+2.3	035	A7	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD INSURANCE ZONE DATA

MARTINEZ CREEK - BEXAR COUNTY - INDIAN CREEK

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Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHFs are determined.
Zones A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17, A19, A20, and A22:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 2.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of San Antonio is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

A Flood Insurance Study for the unincorporated areas of Bexar County, Texas, has been prepared and is currently being revised to incorporate updated analyses for Salado Creek (Reference 28). The results of that revised study will be in agreement with the results of this study.

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7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region VI Office, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

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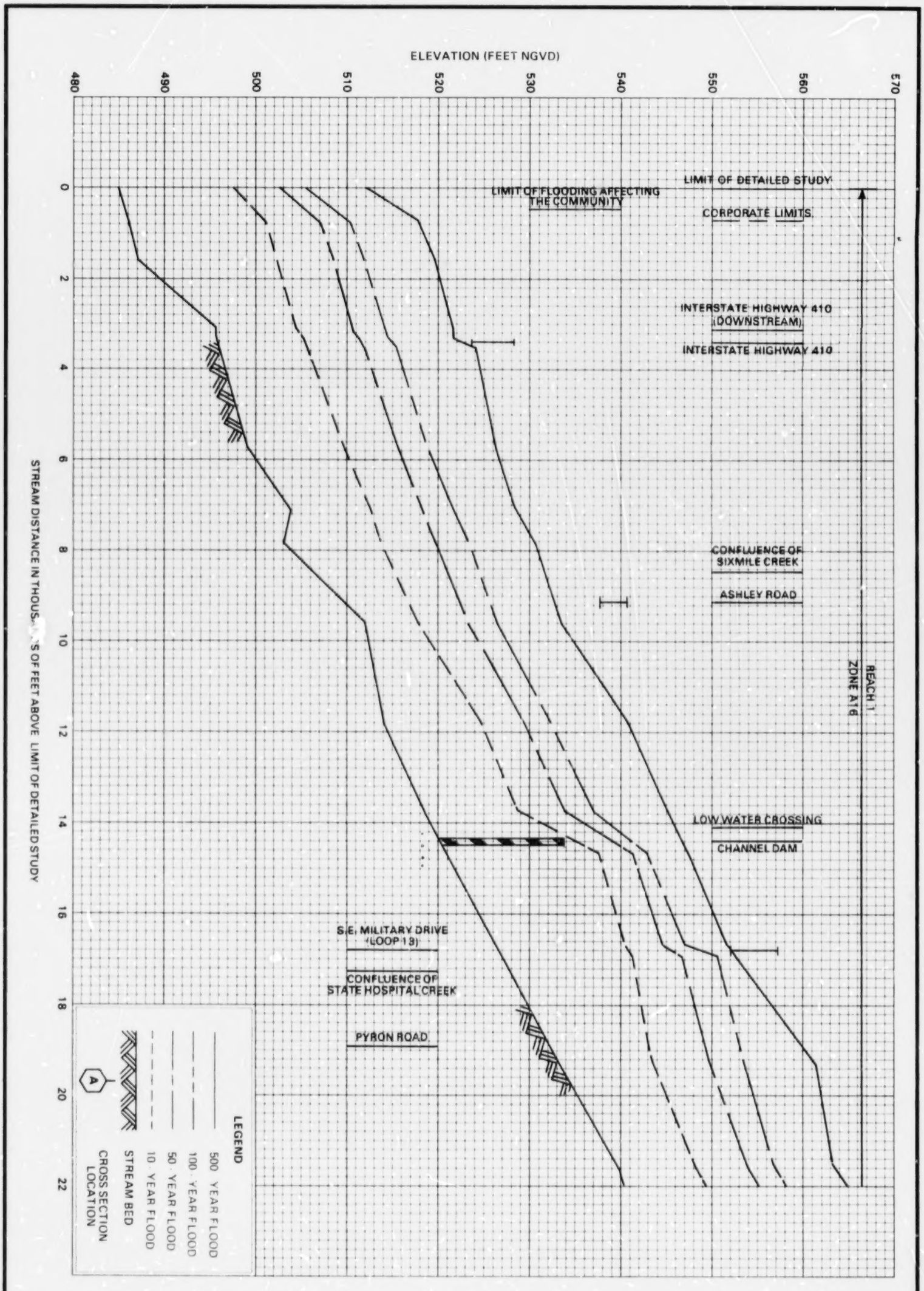

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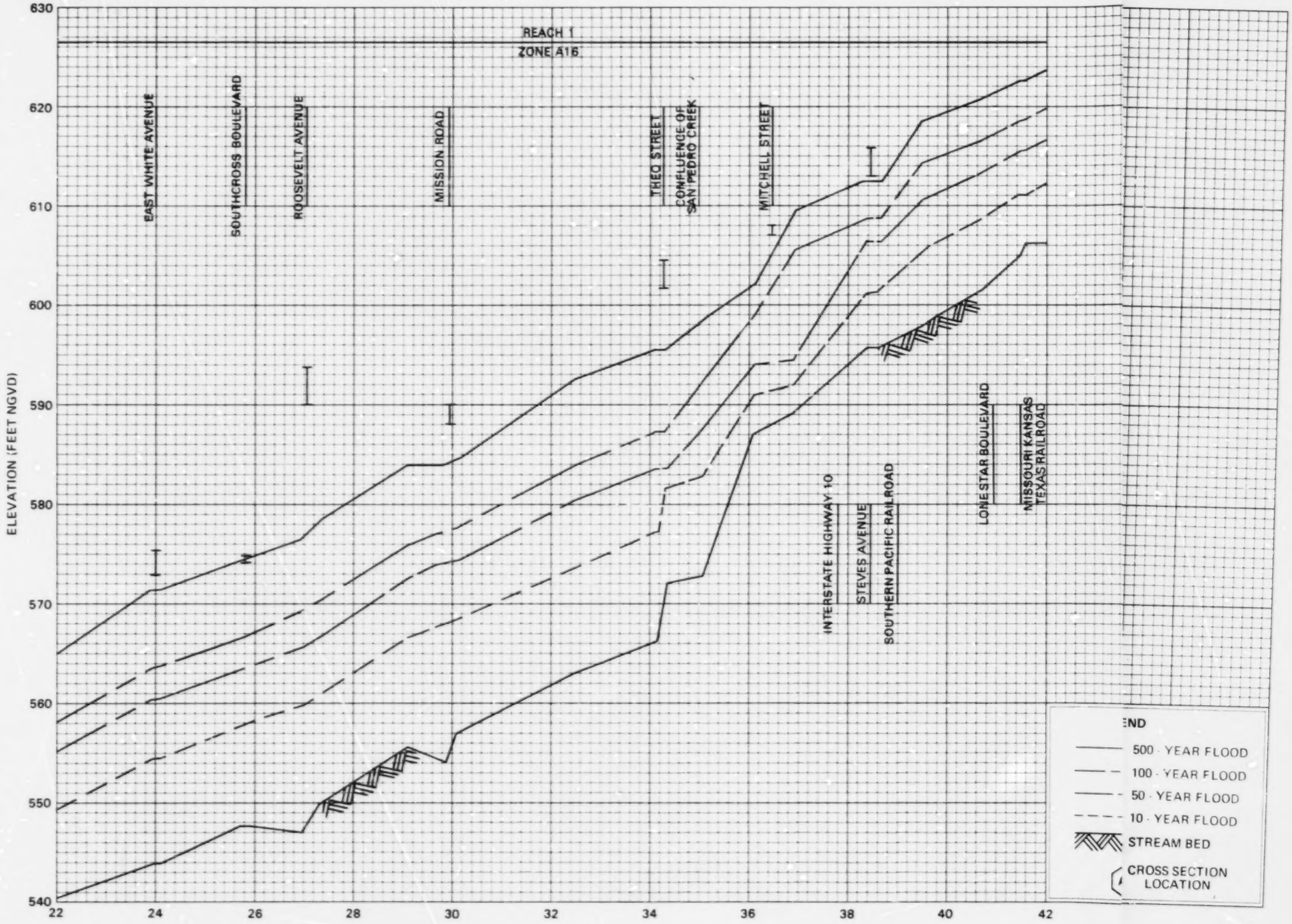

FLOOD PROFILES

SAN ANTONIO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

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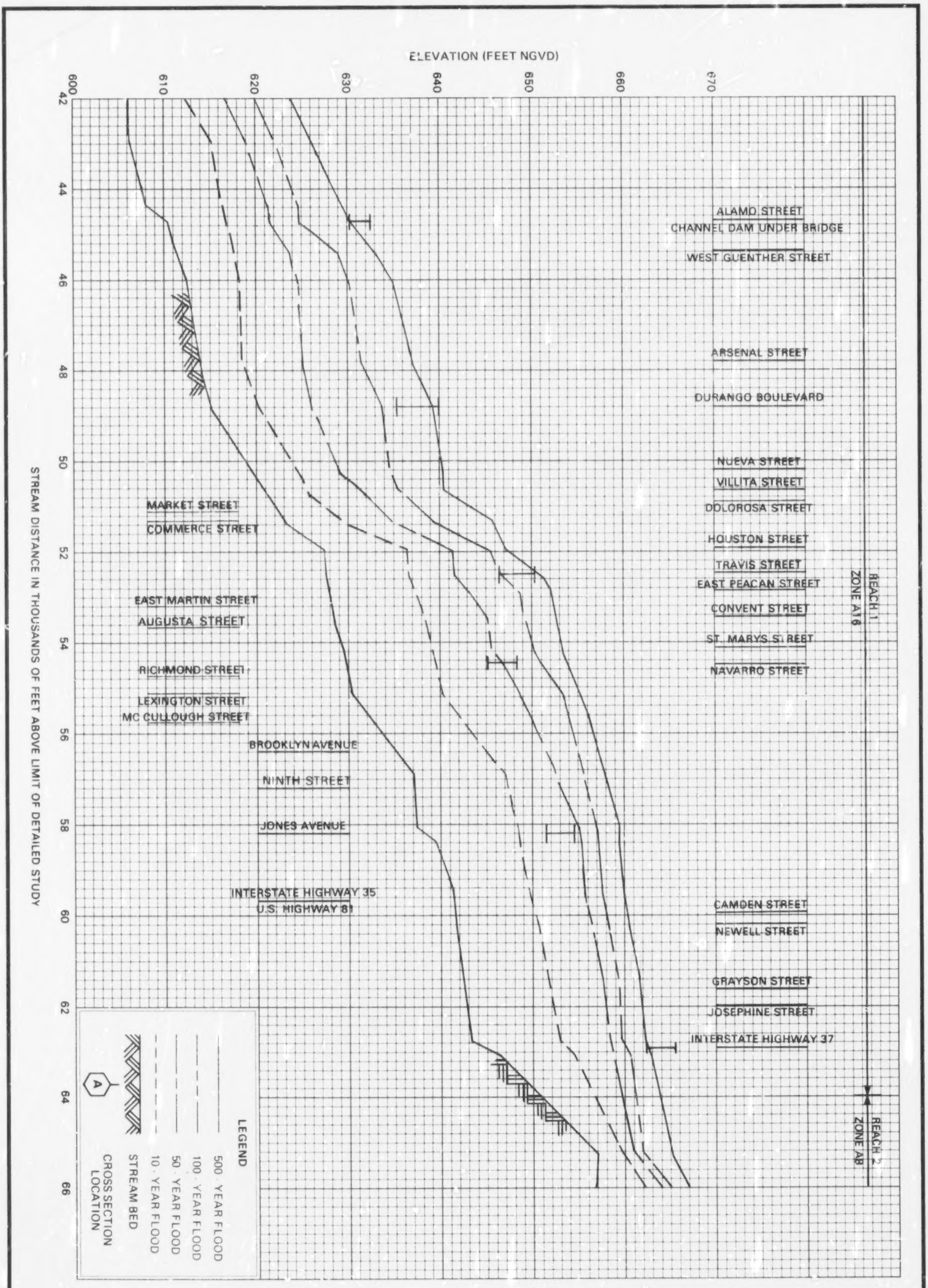

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FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SAN ANTONIO RIVER

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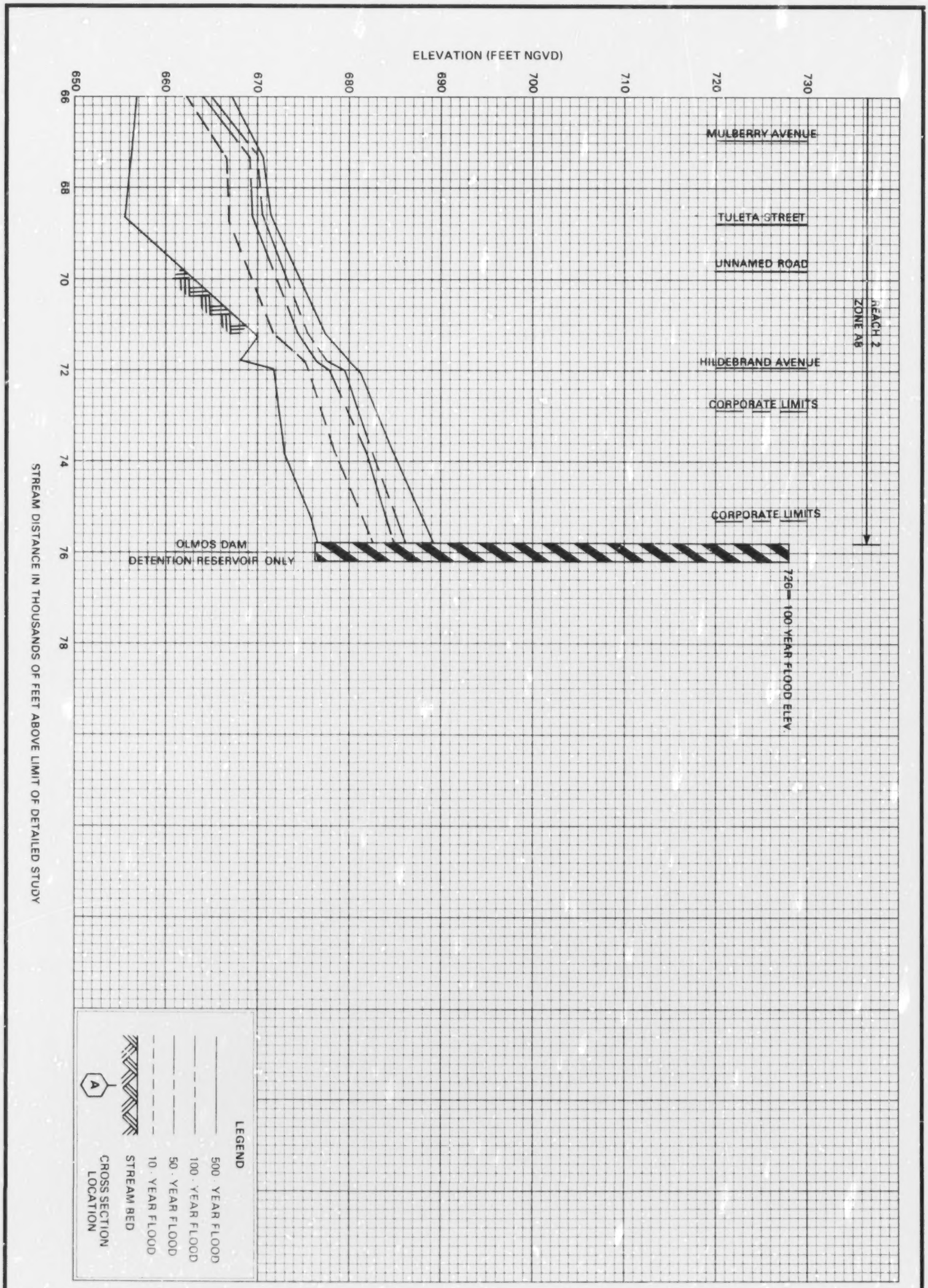

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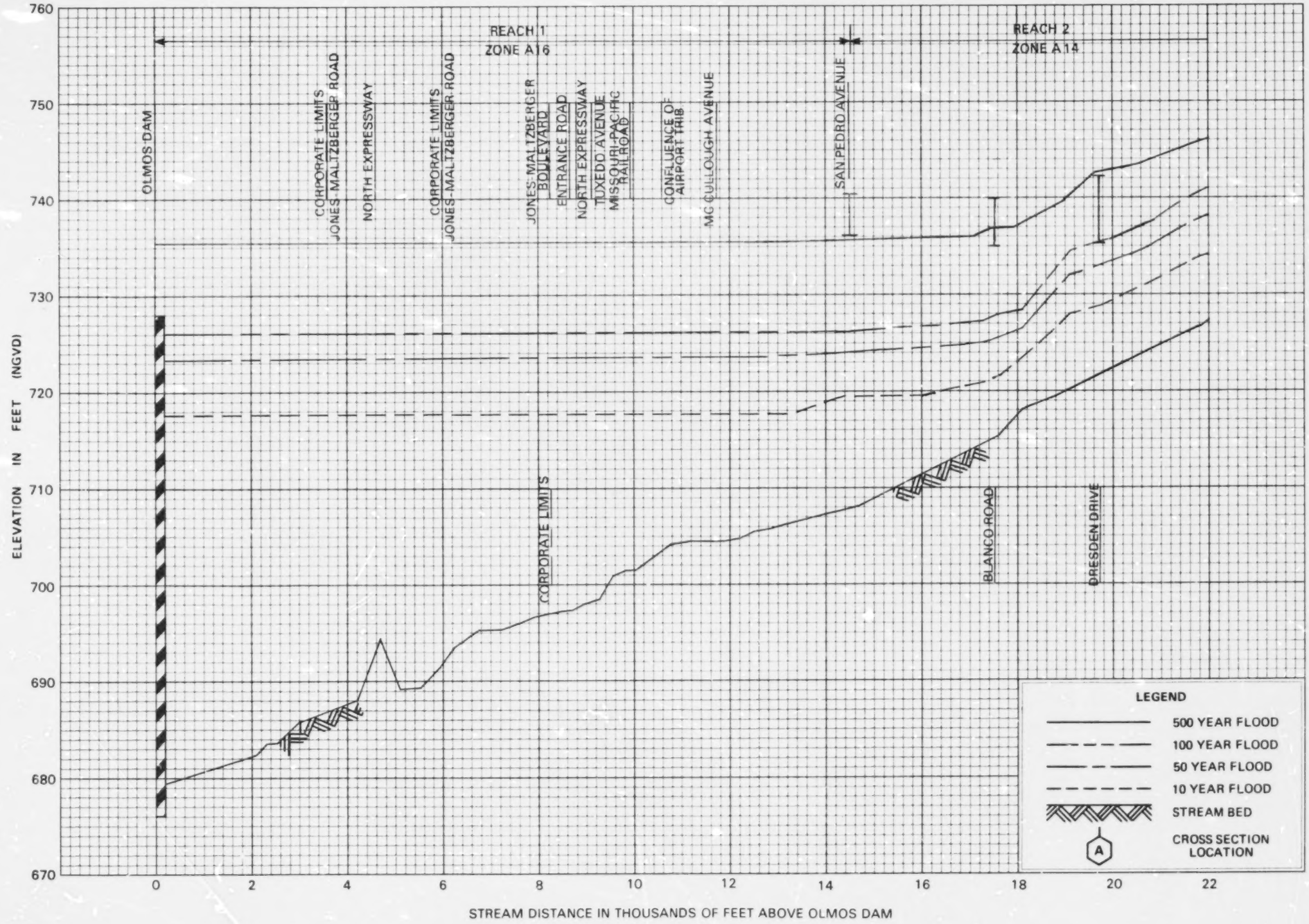

FLOOD PROFILES

OLMOS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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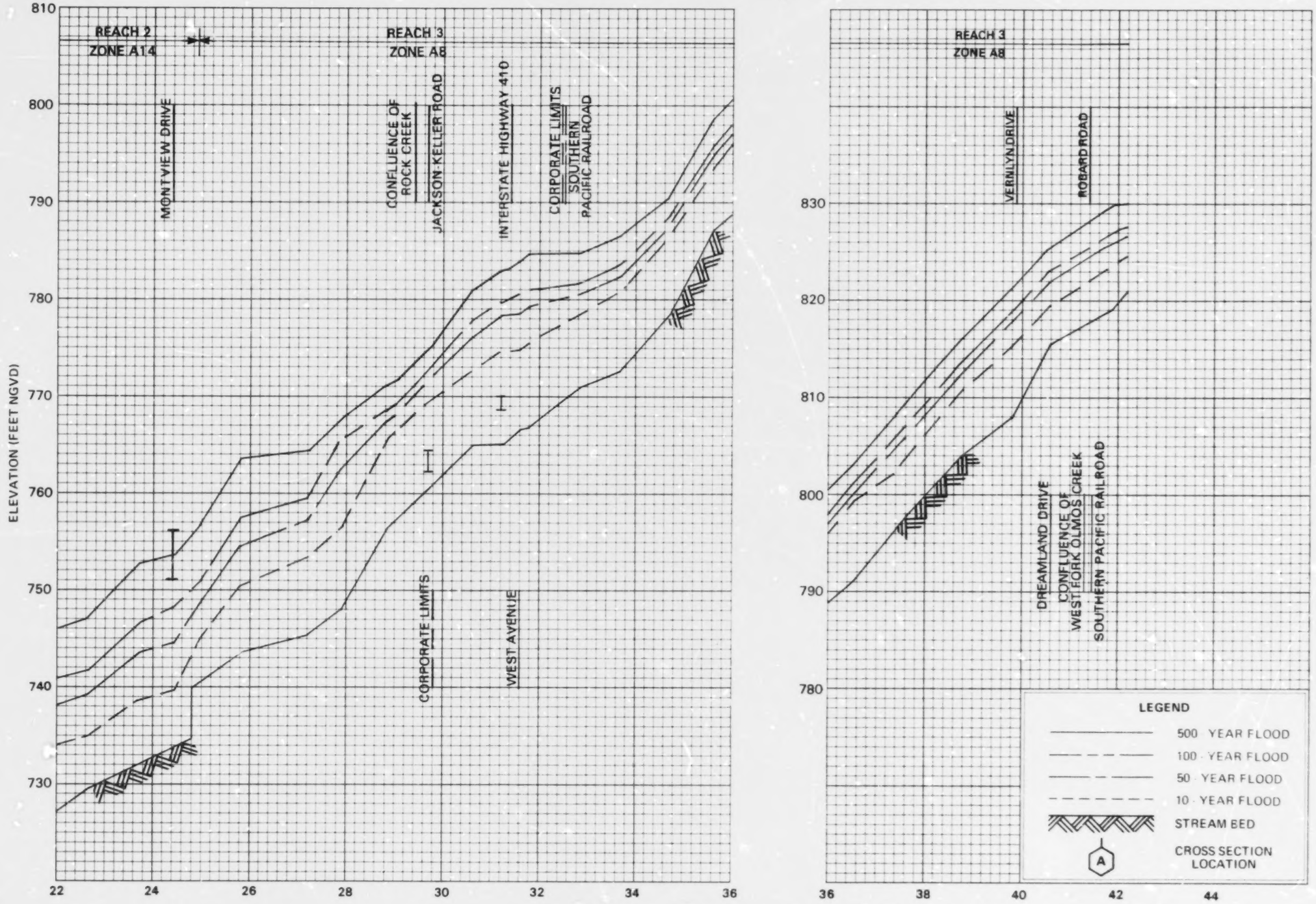

FLOOD PROFILES

OLMOS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

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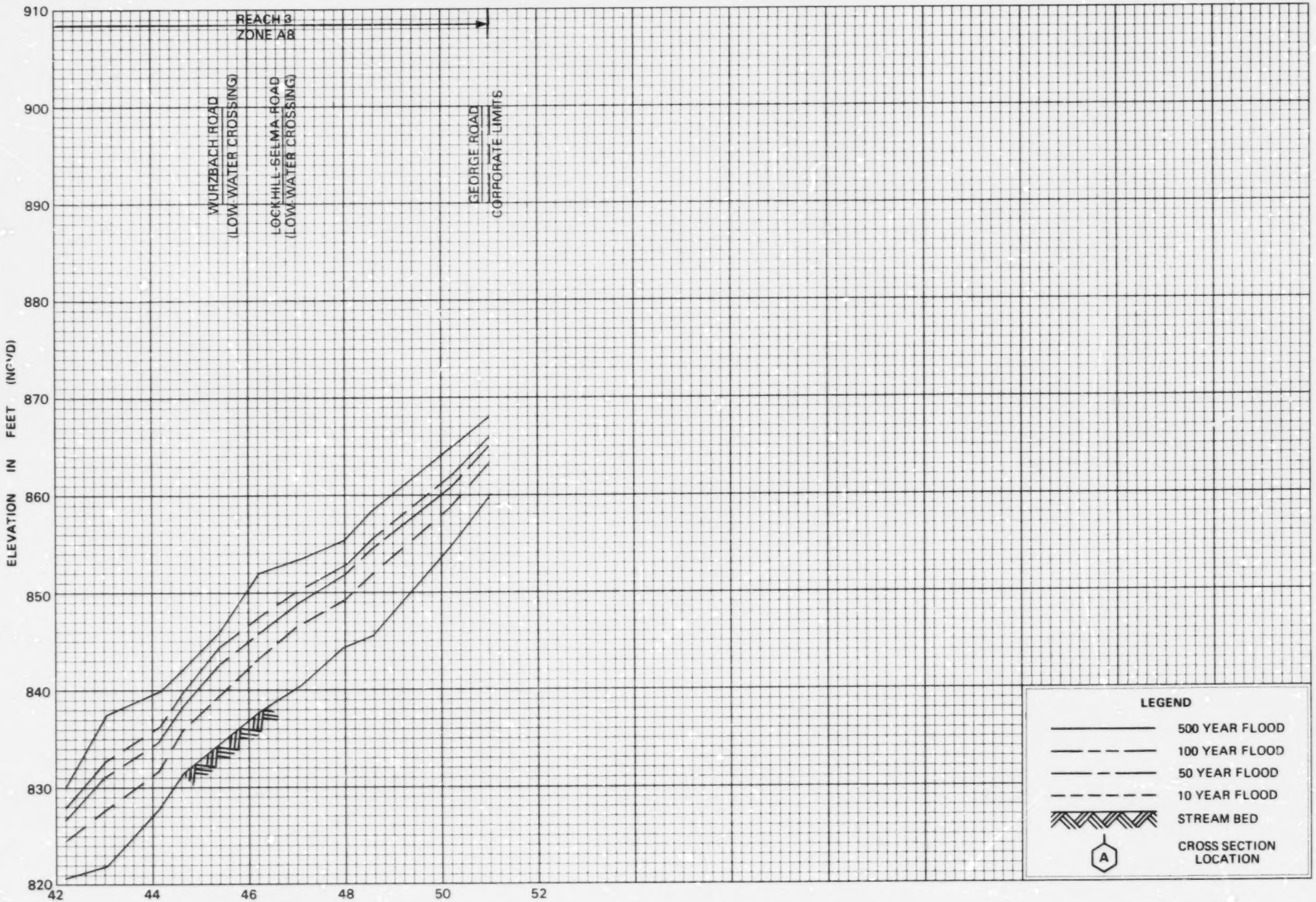

FLOOD PROFILES

OLMOS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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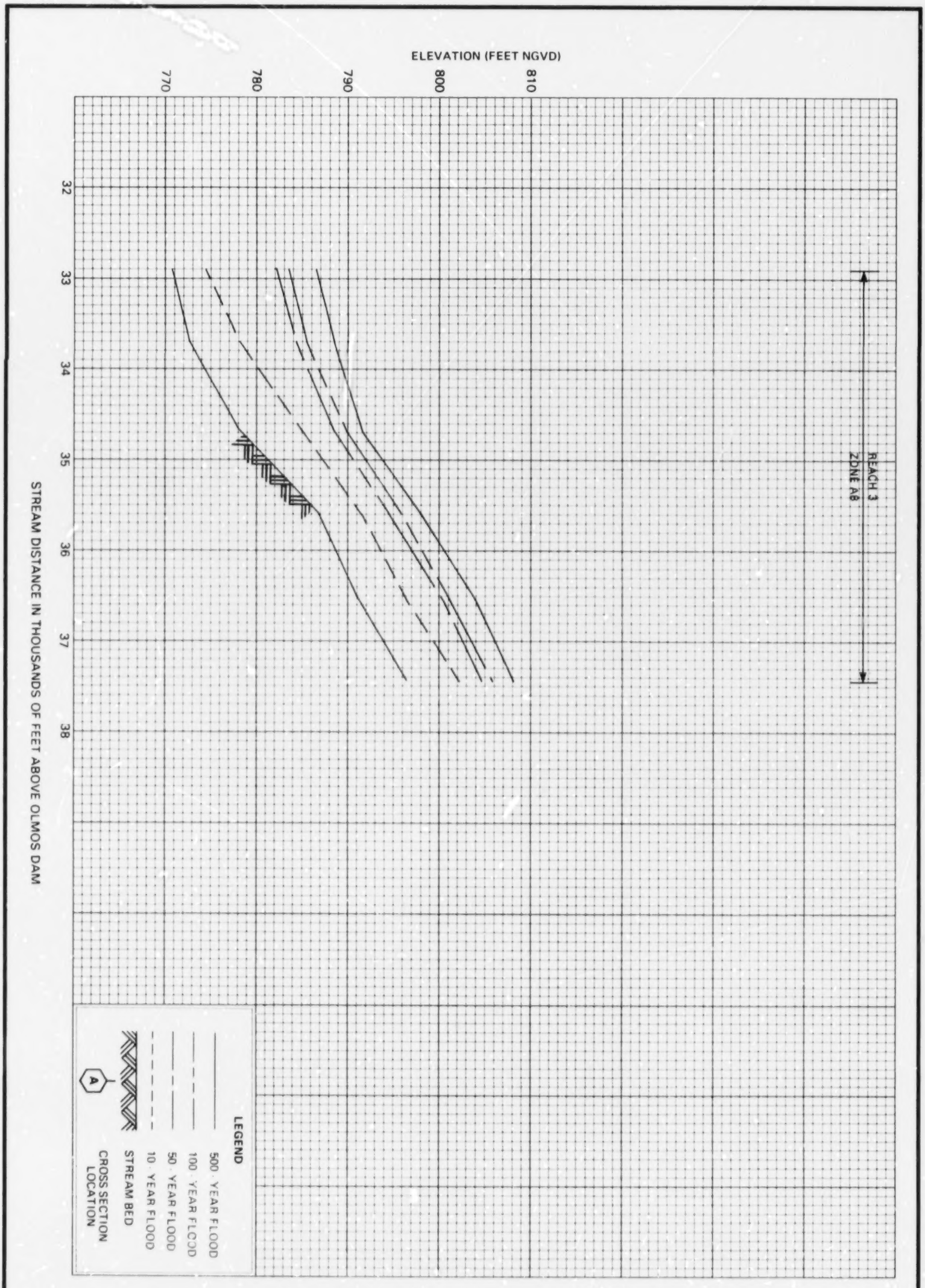

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

OLMOS CREEK (EAST CHANNEL)

08P

4/3

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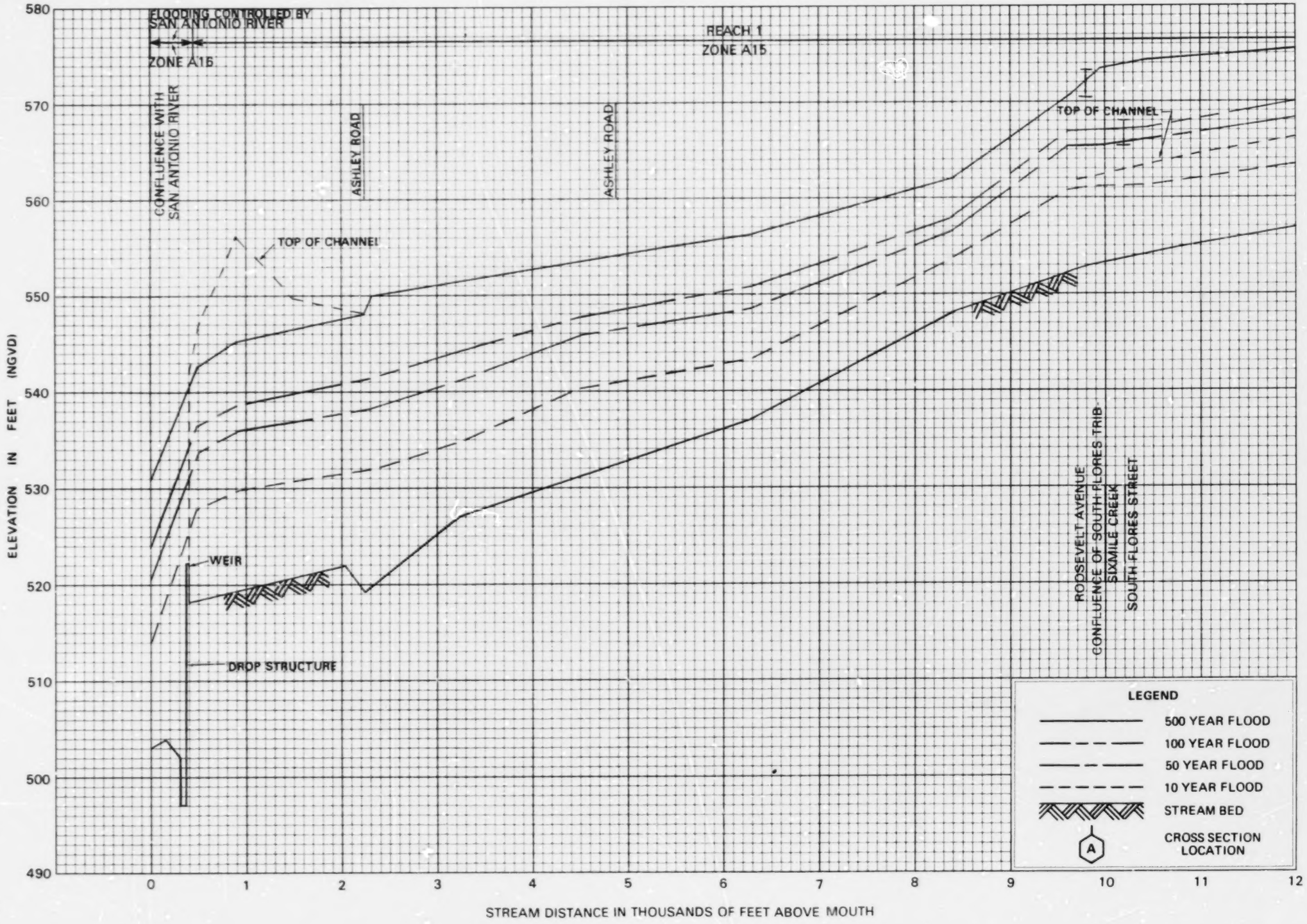

FLOOD PROFILES

SIXMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

09P

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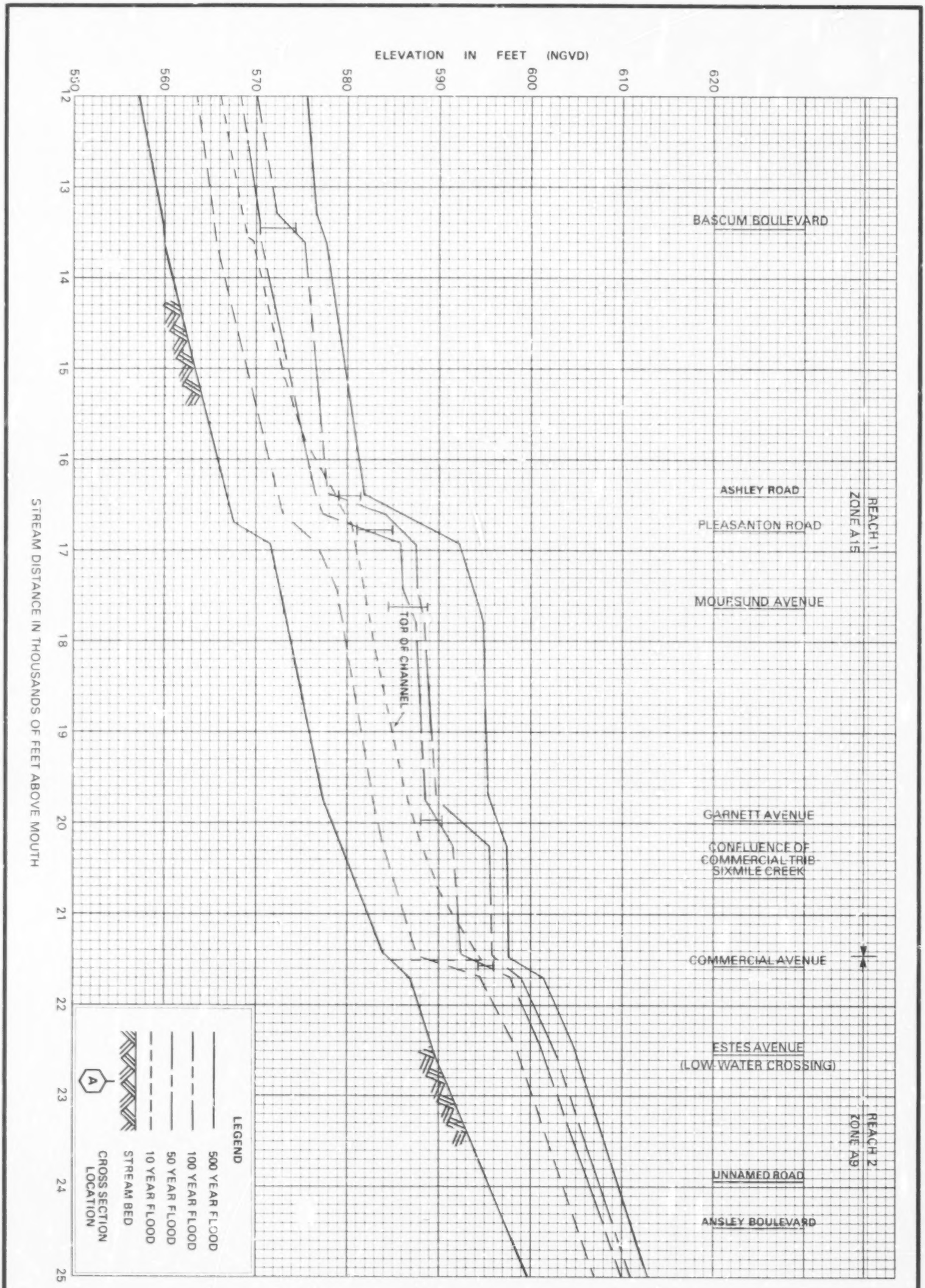

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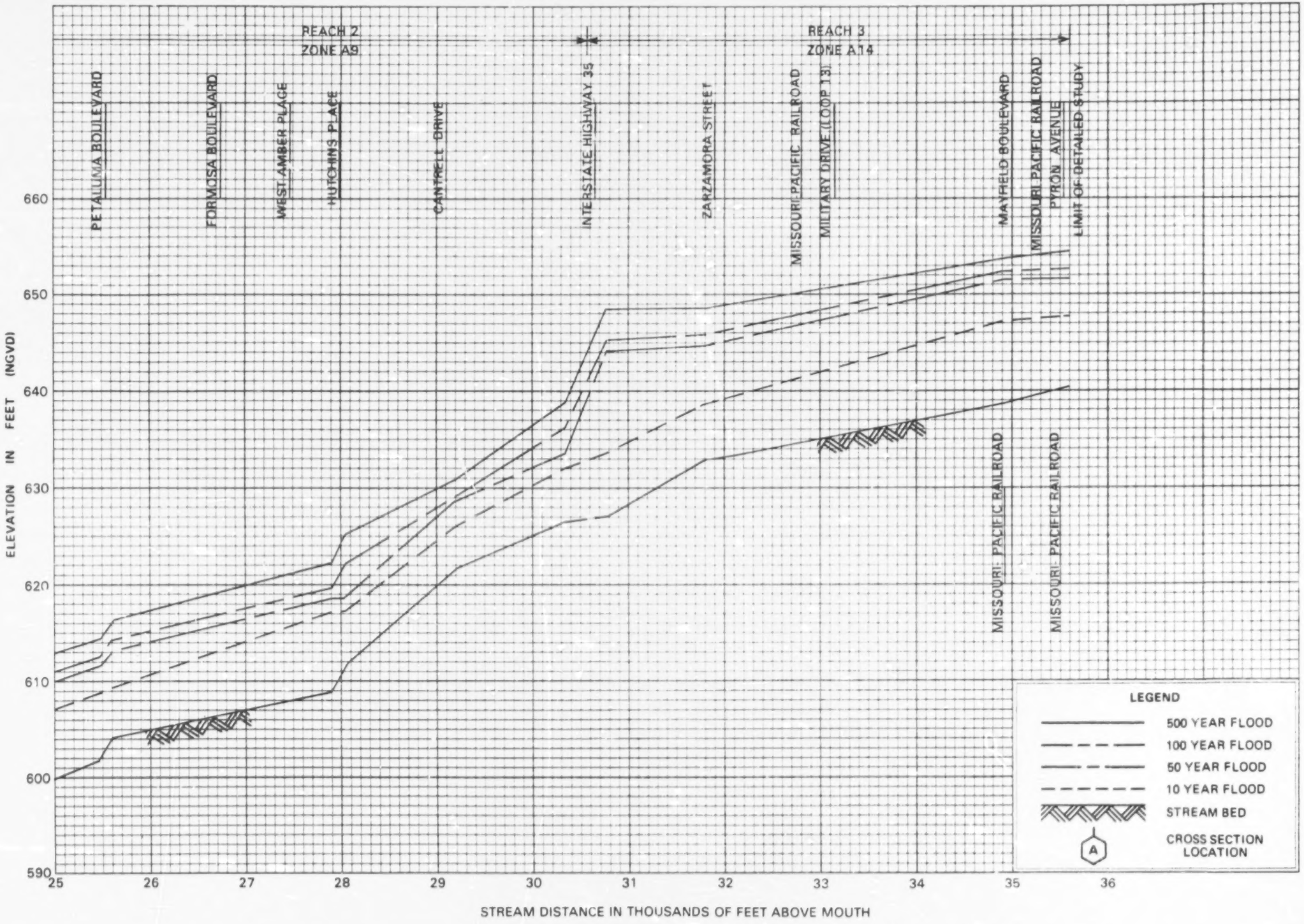

FLOOD PROFILES

SIXMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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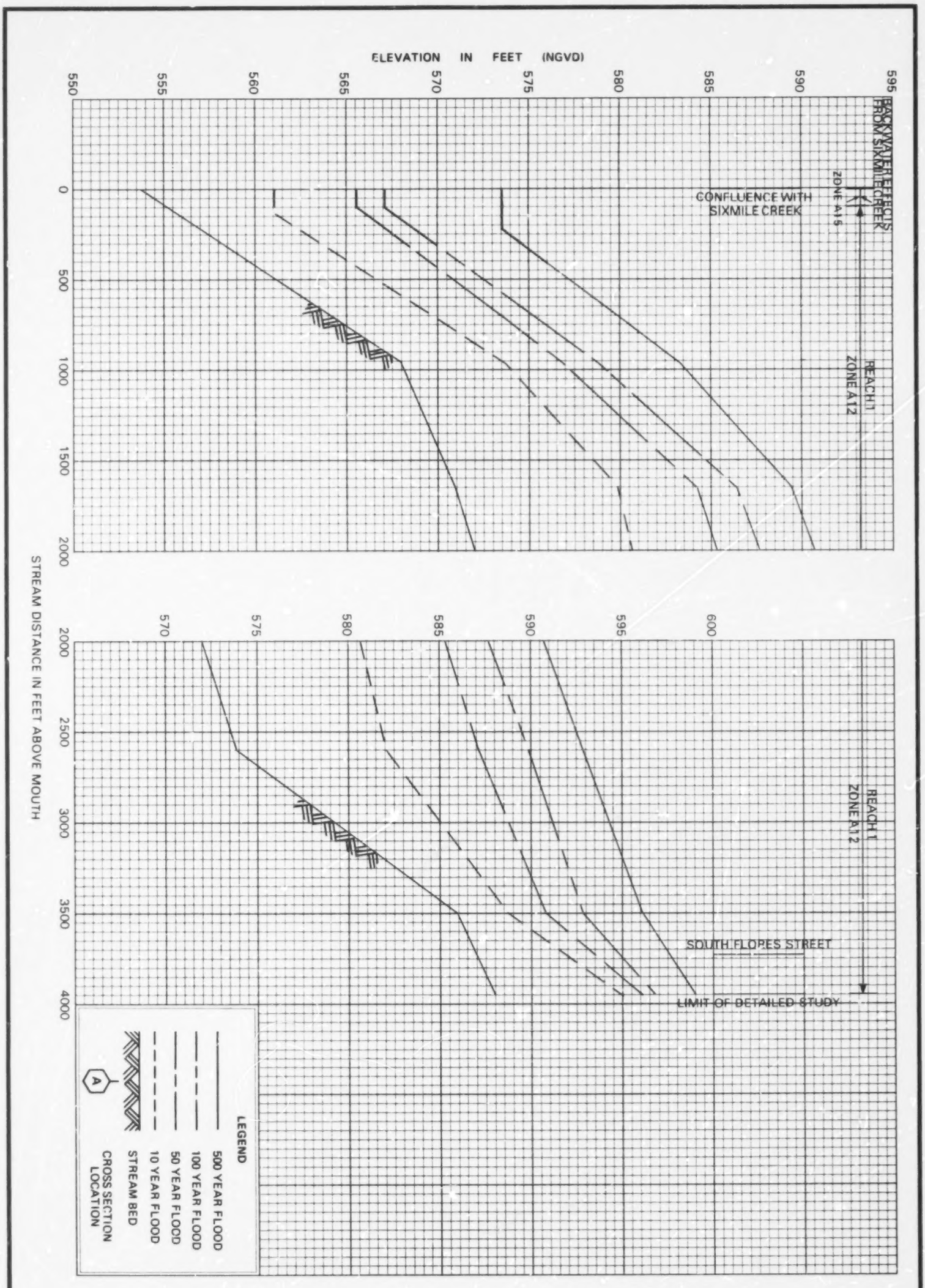

12P	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOOD PROFILES
	CITY OF SAN ANTONIO, TX (BEXAR CO.)	SOUTH FLORES TRIB. (SIXMILE CREEK)

47

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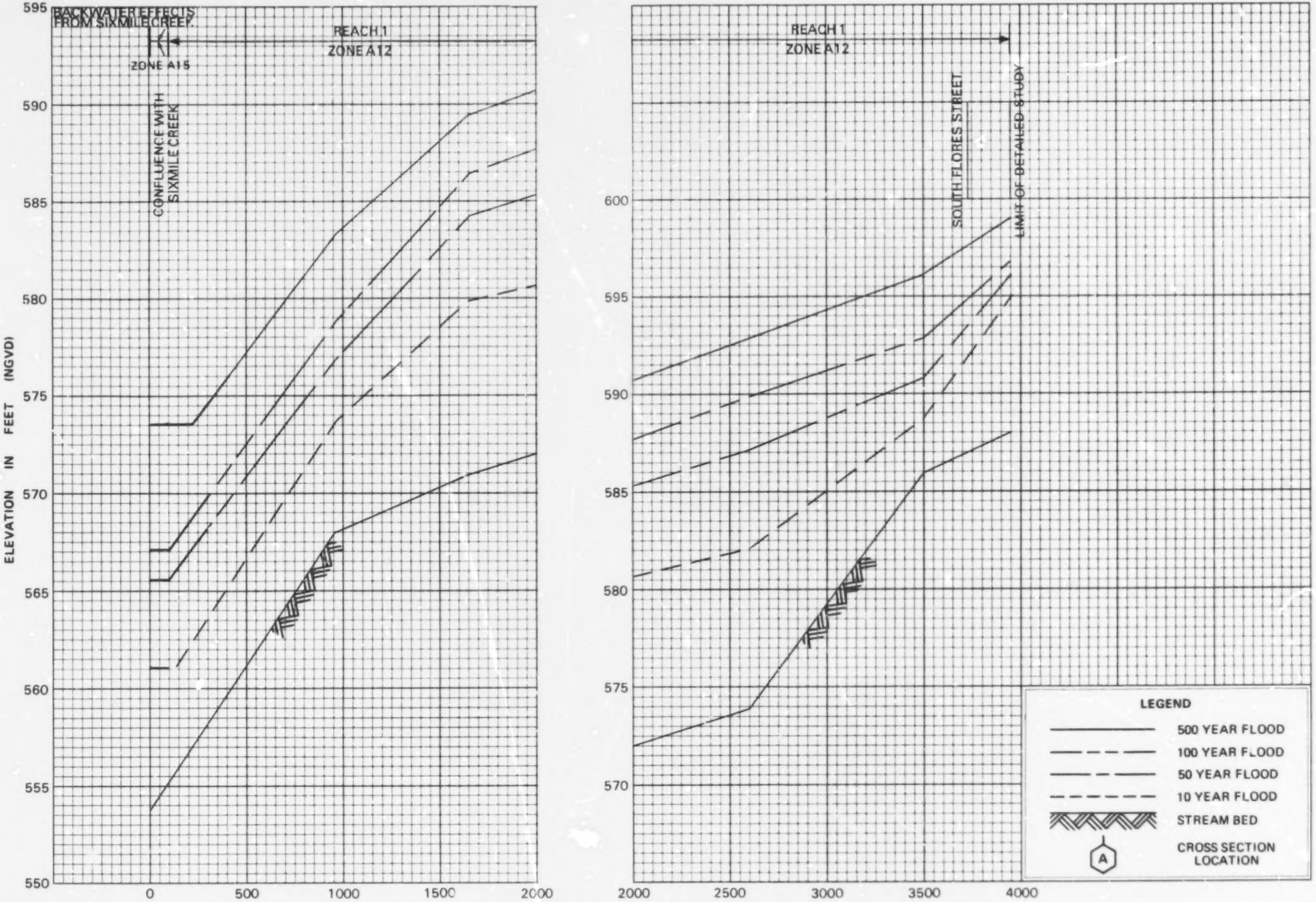

FLOOD PROFILES

SOUTH FLORES TRIB. (SIXMILE CREEK)

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CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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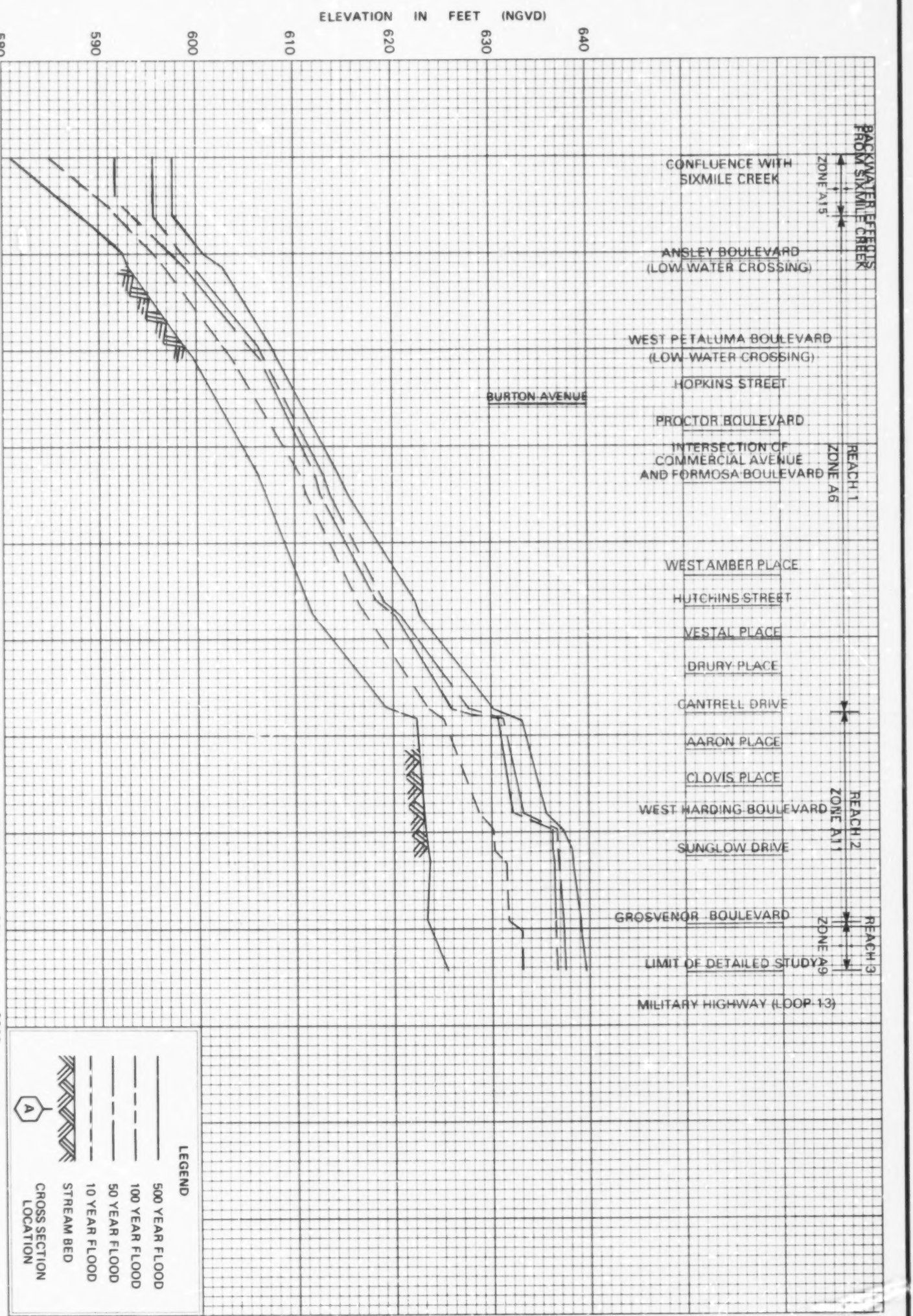

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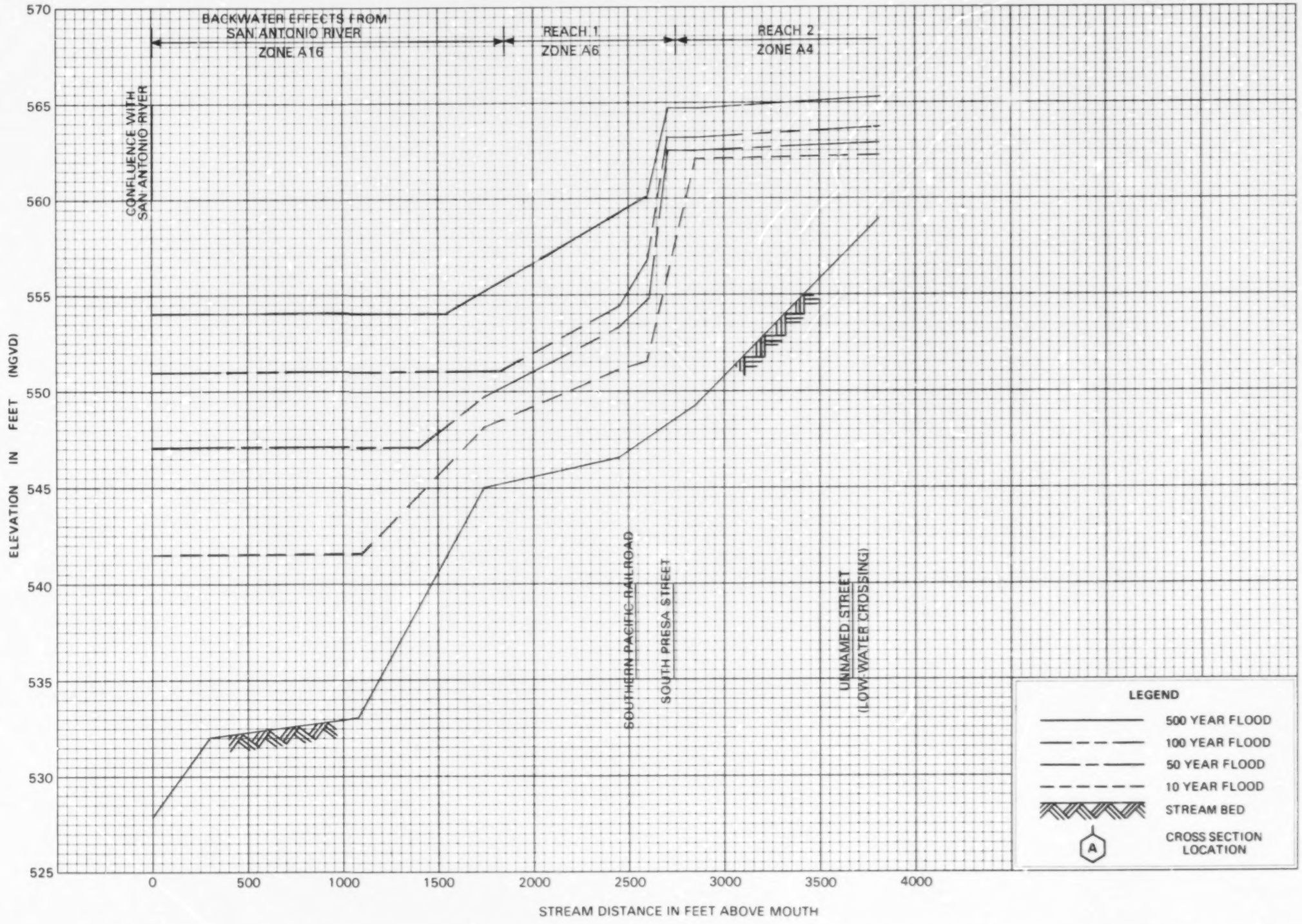

FLOOD PROFILES

STATE HOSPITAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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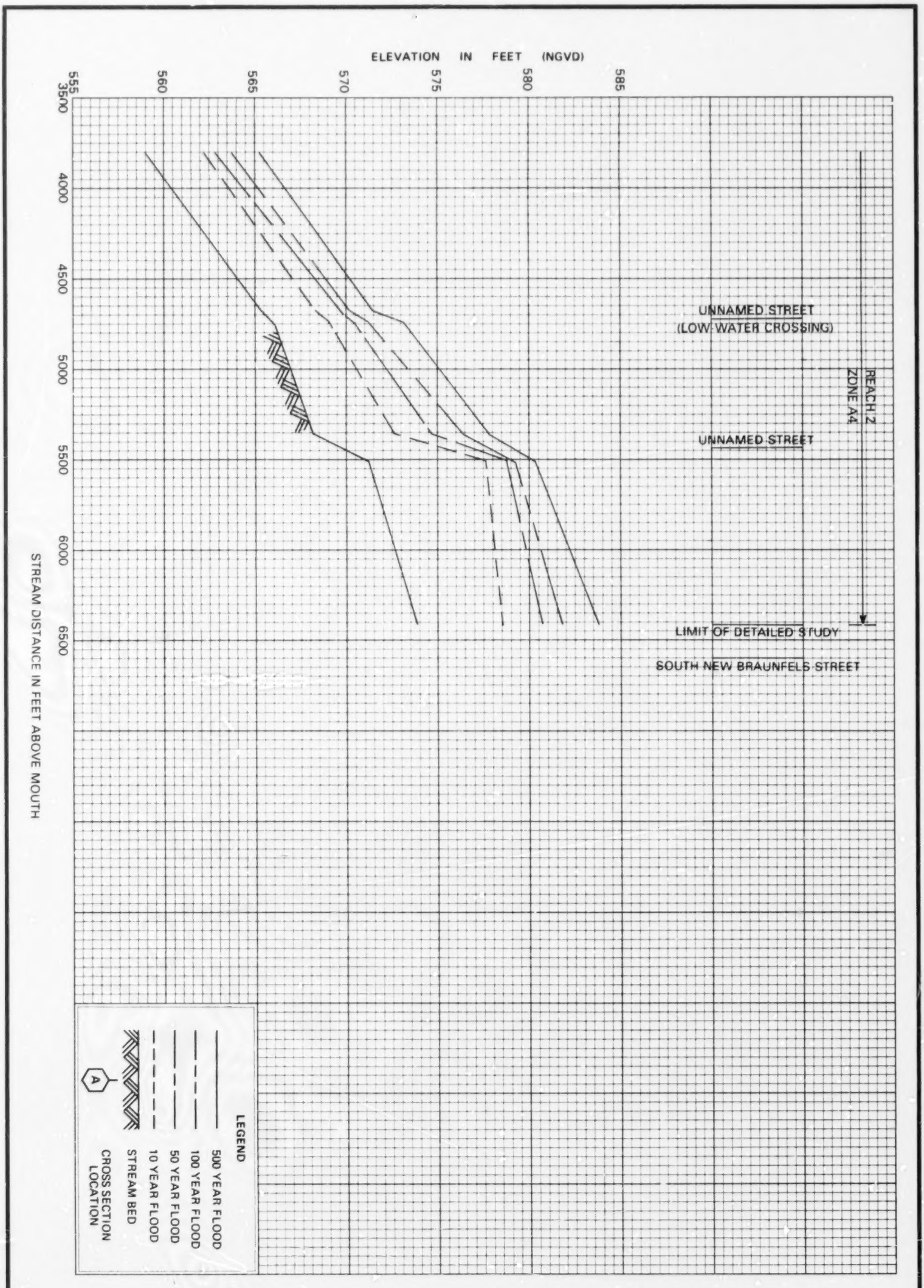

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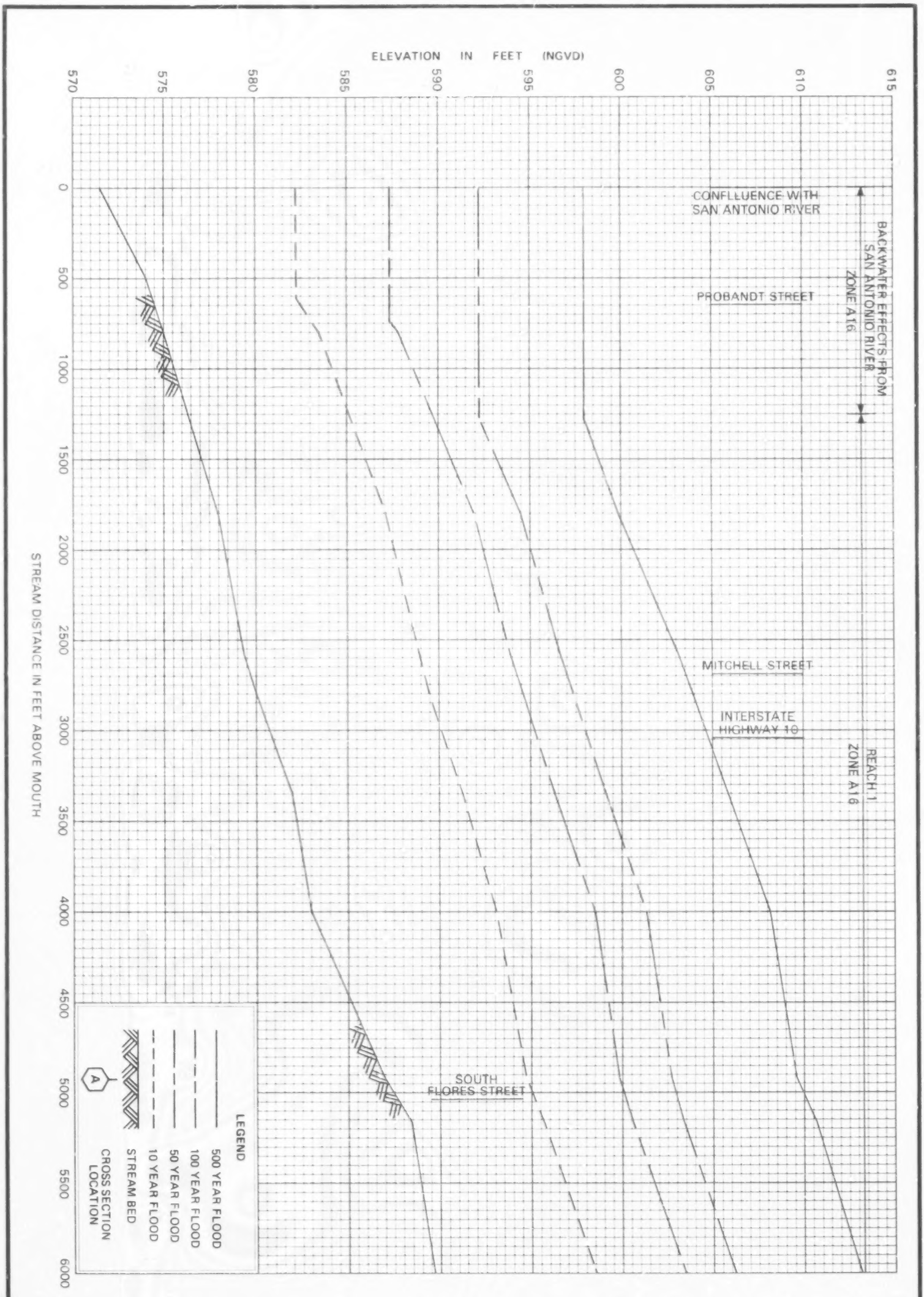

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

16P

FLOOD PROFILES

SAN PEDRO CREEK

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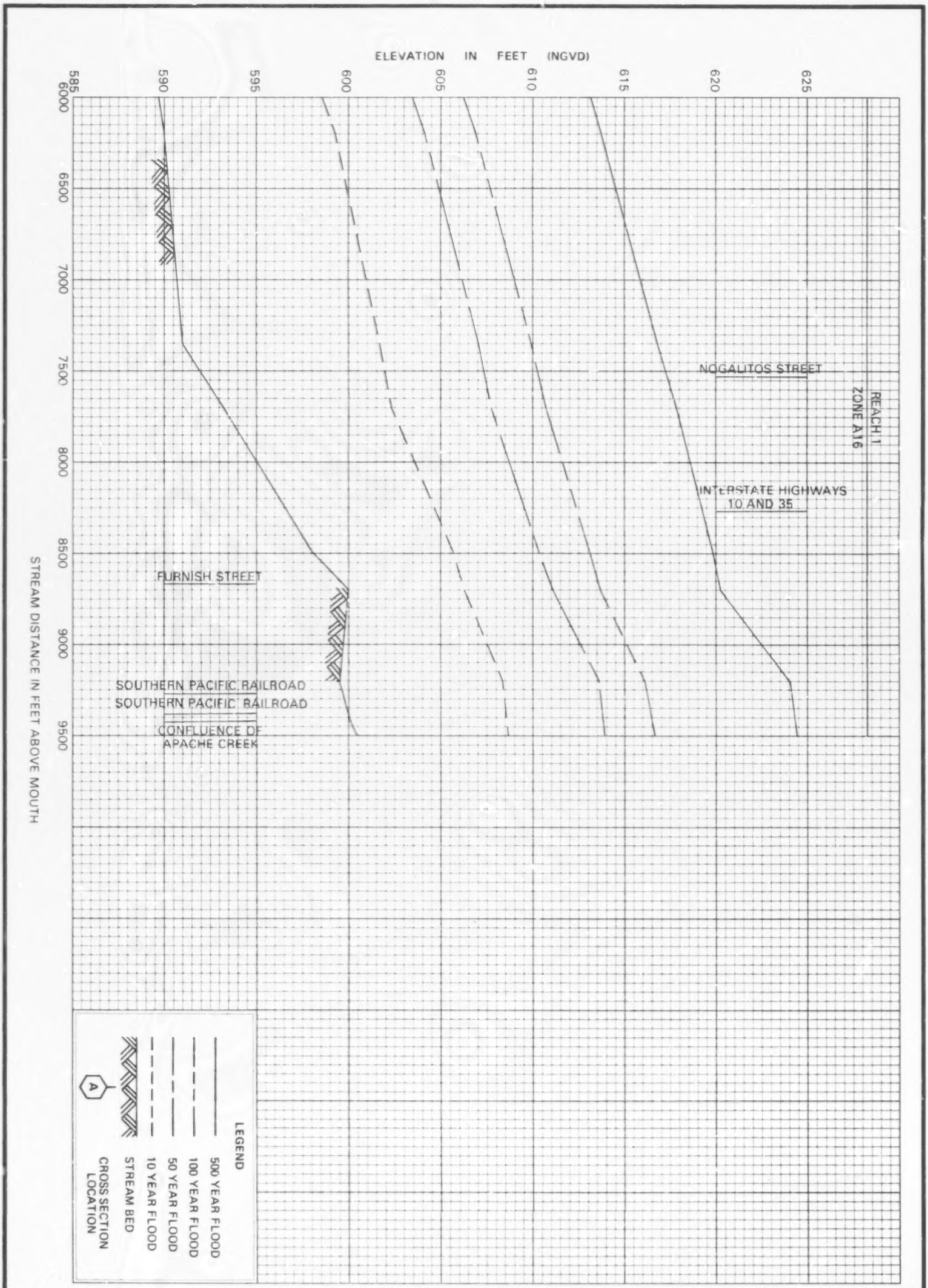

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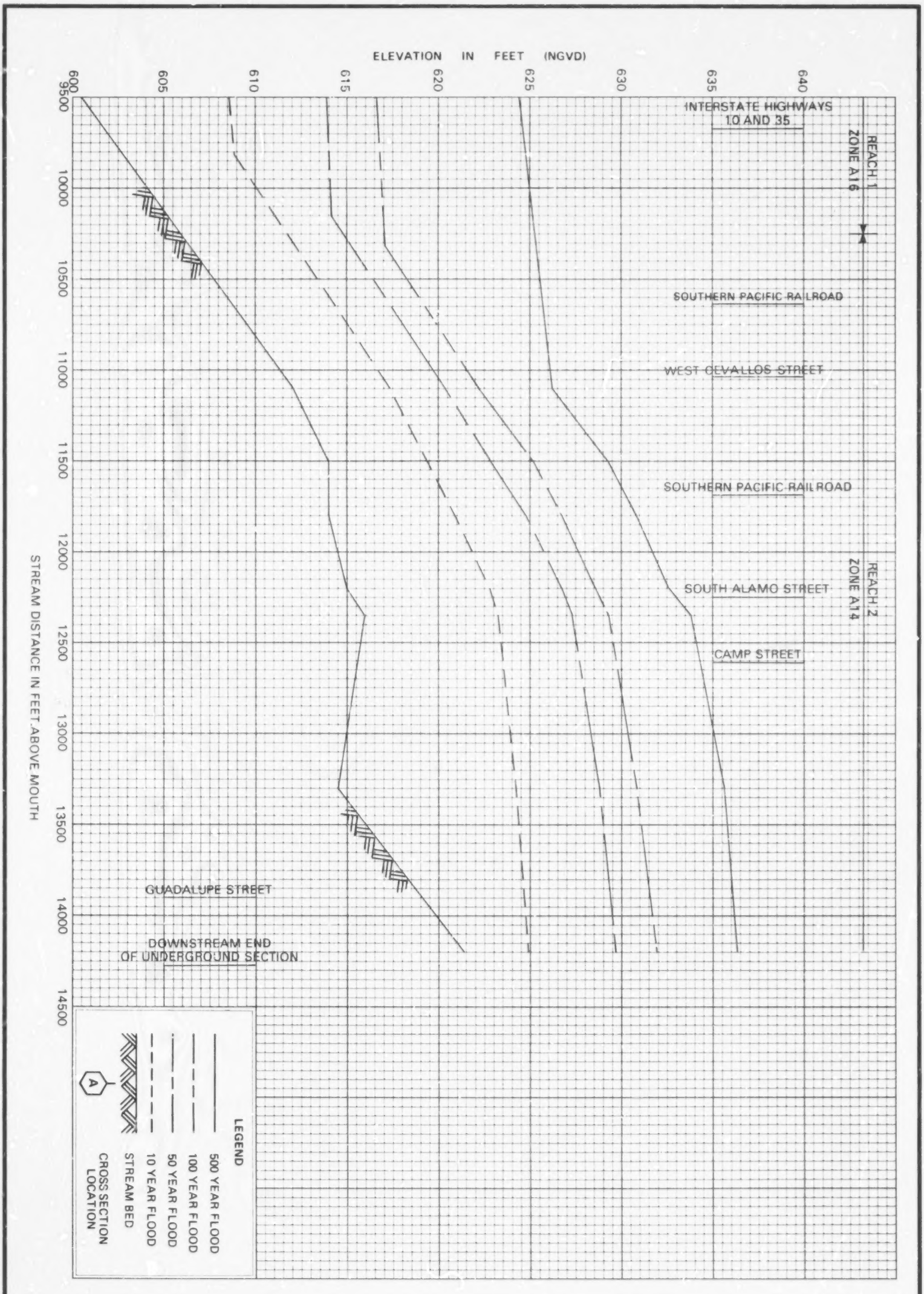

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FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SAN PEDRO CREEK

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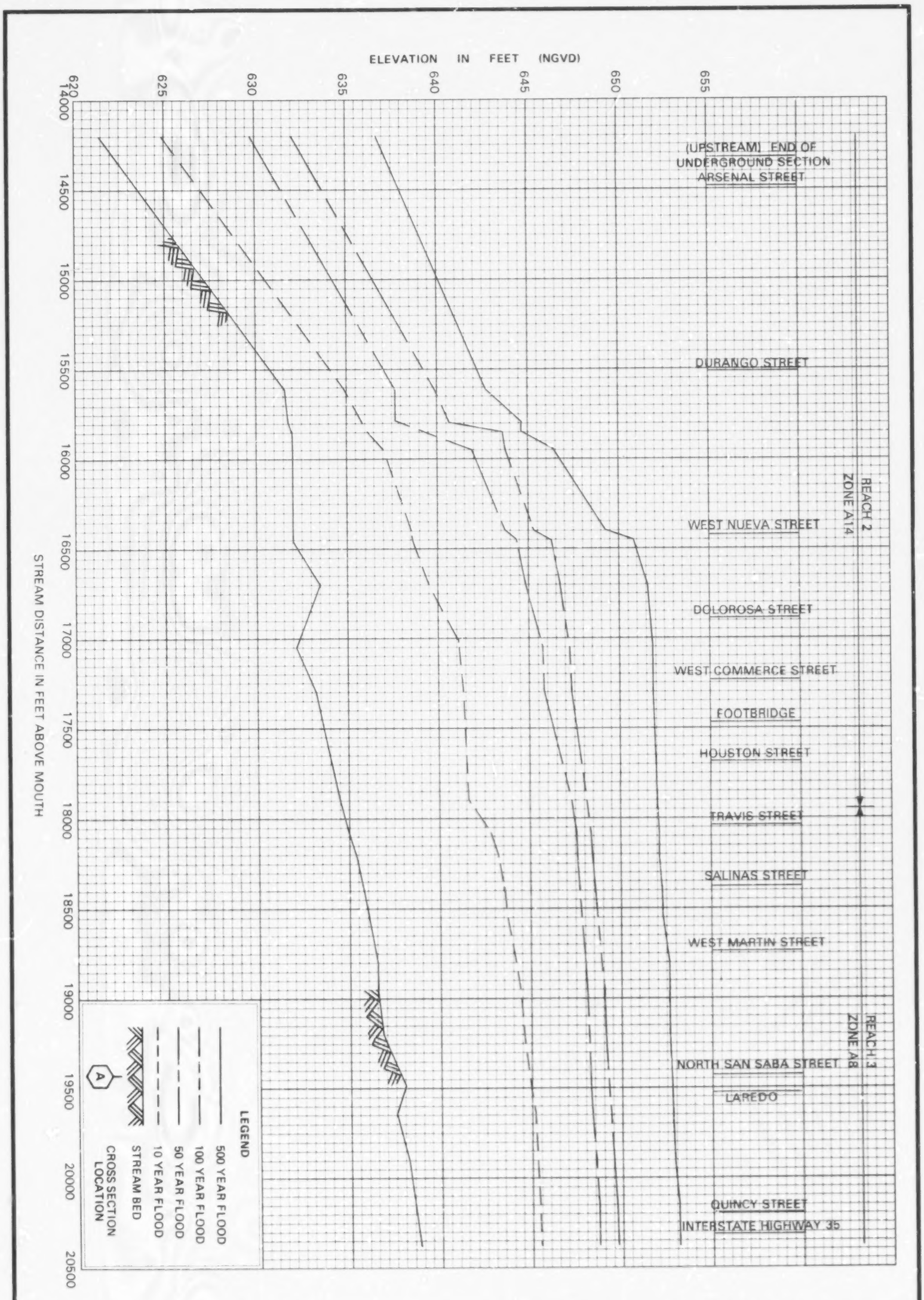

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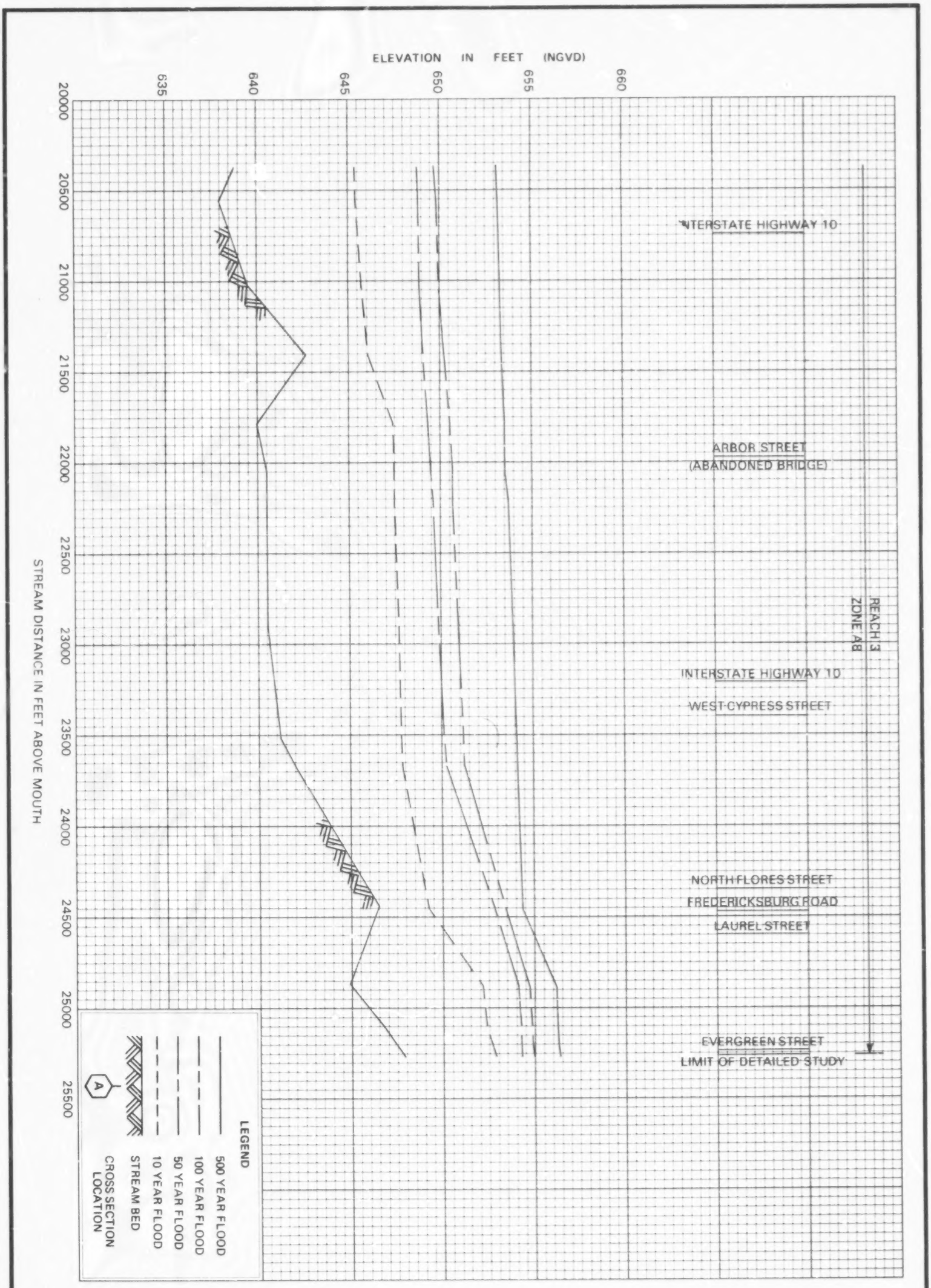

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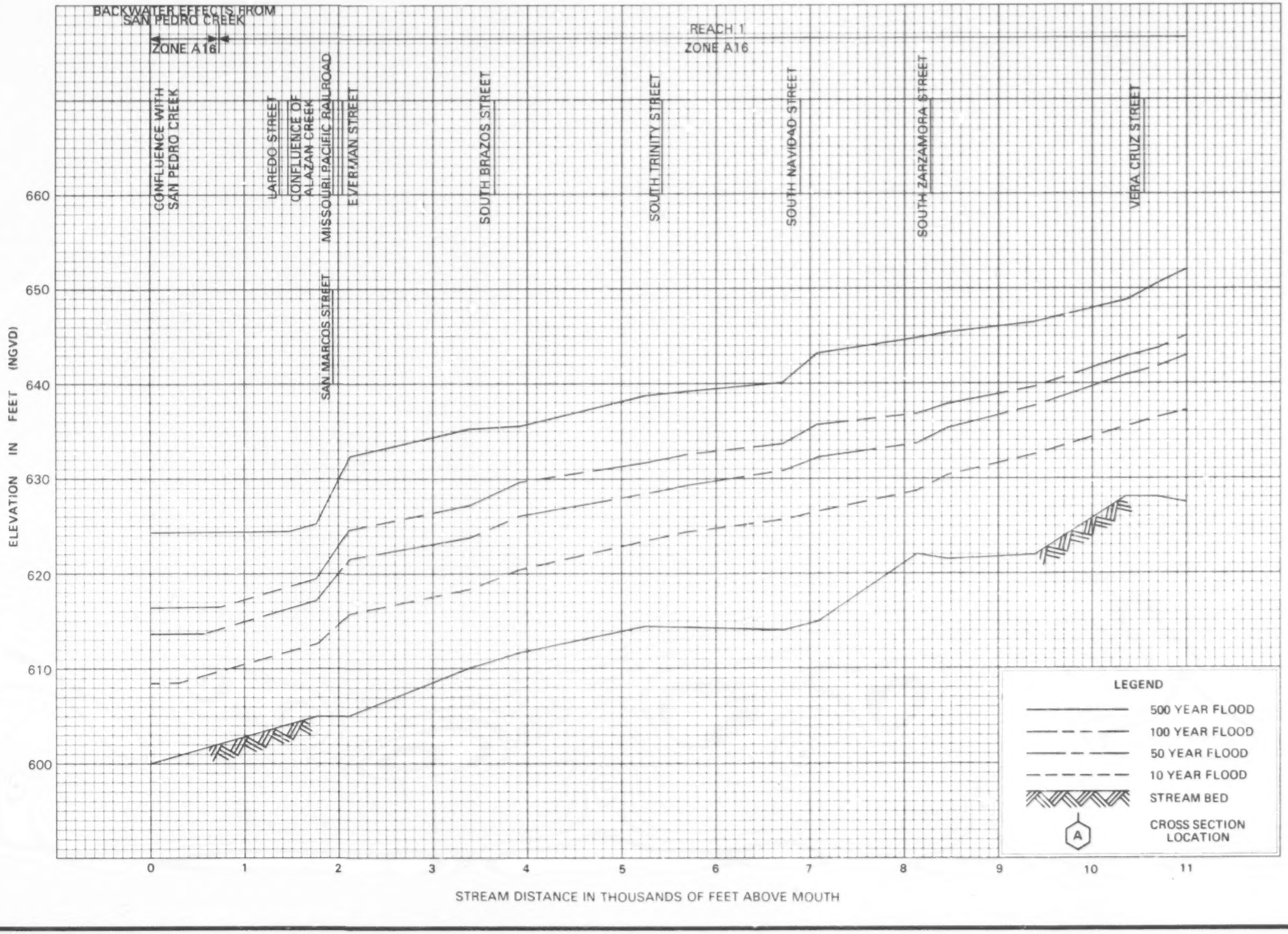

FLOOD PROFILES

APACHE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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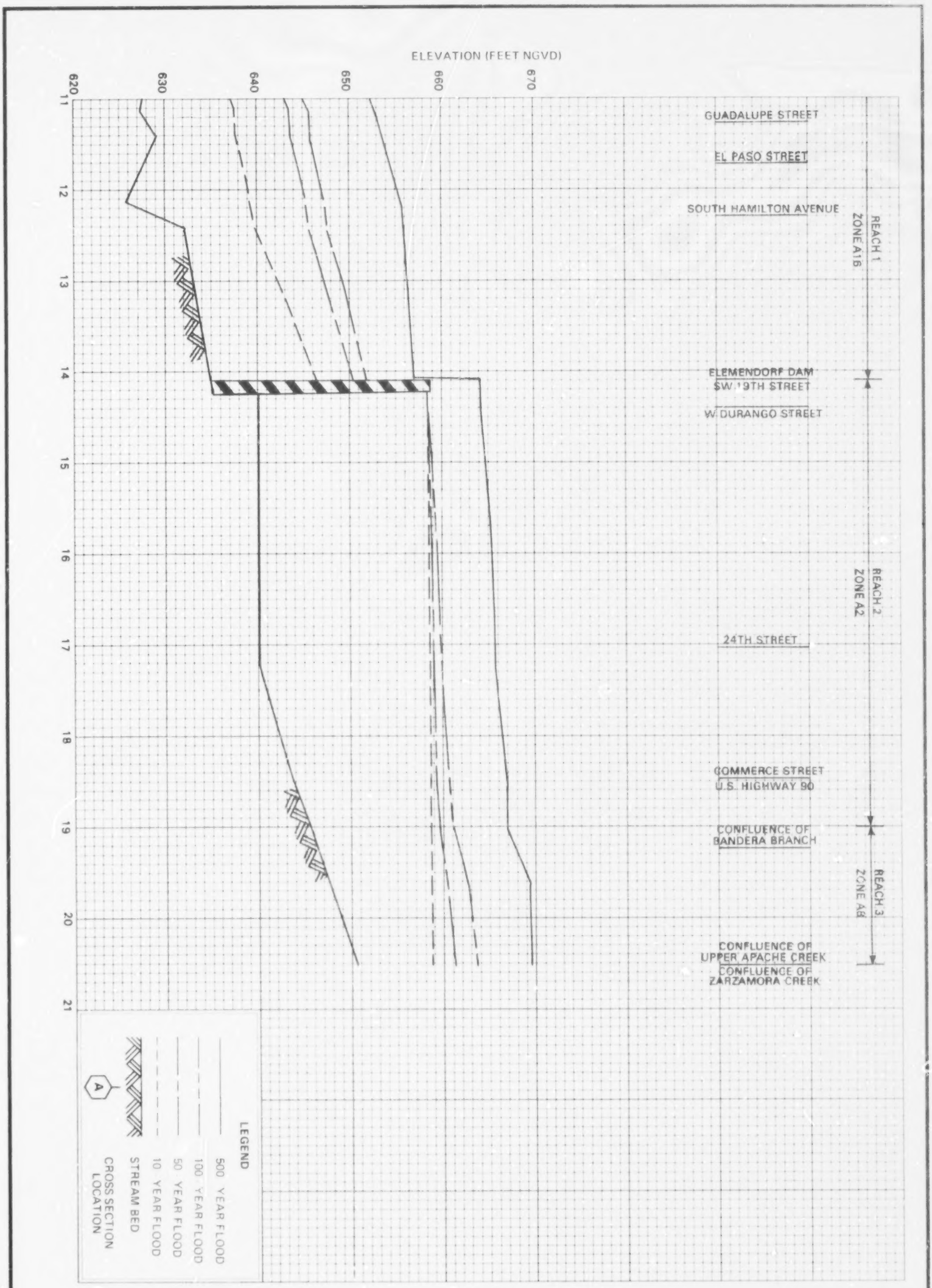

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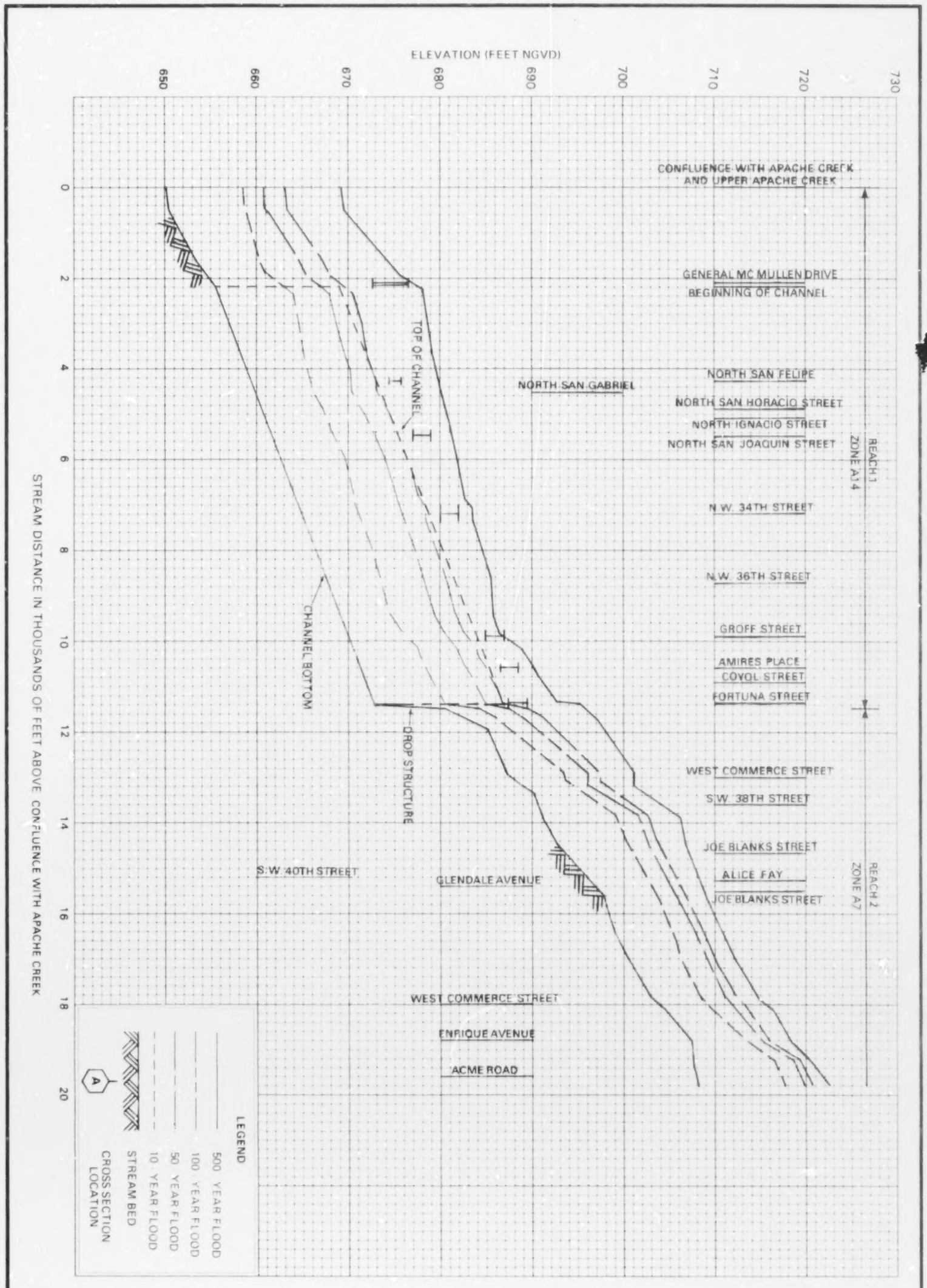
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

APACHE CREEK



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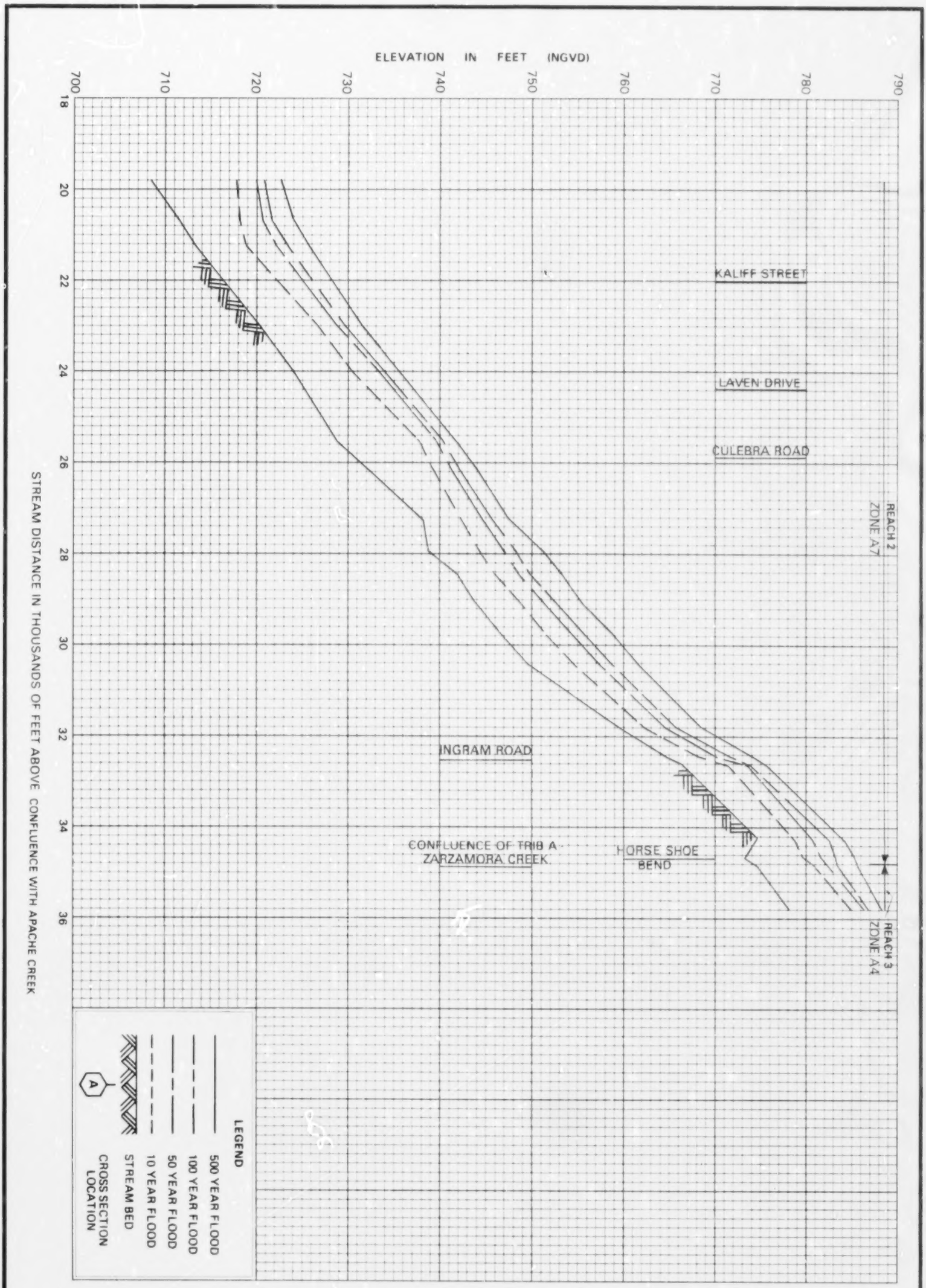
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

ZARZAMORA CREEK



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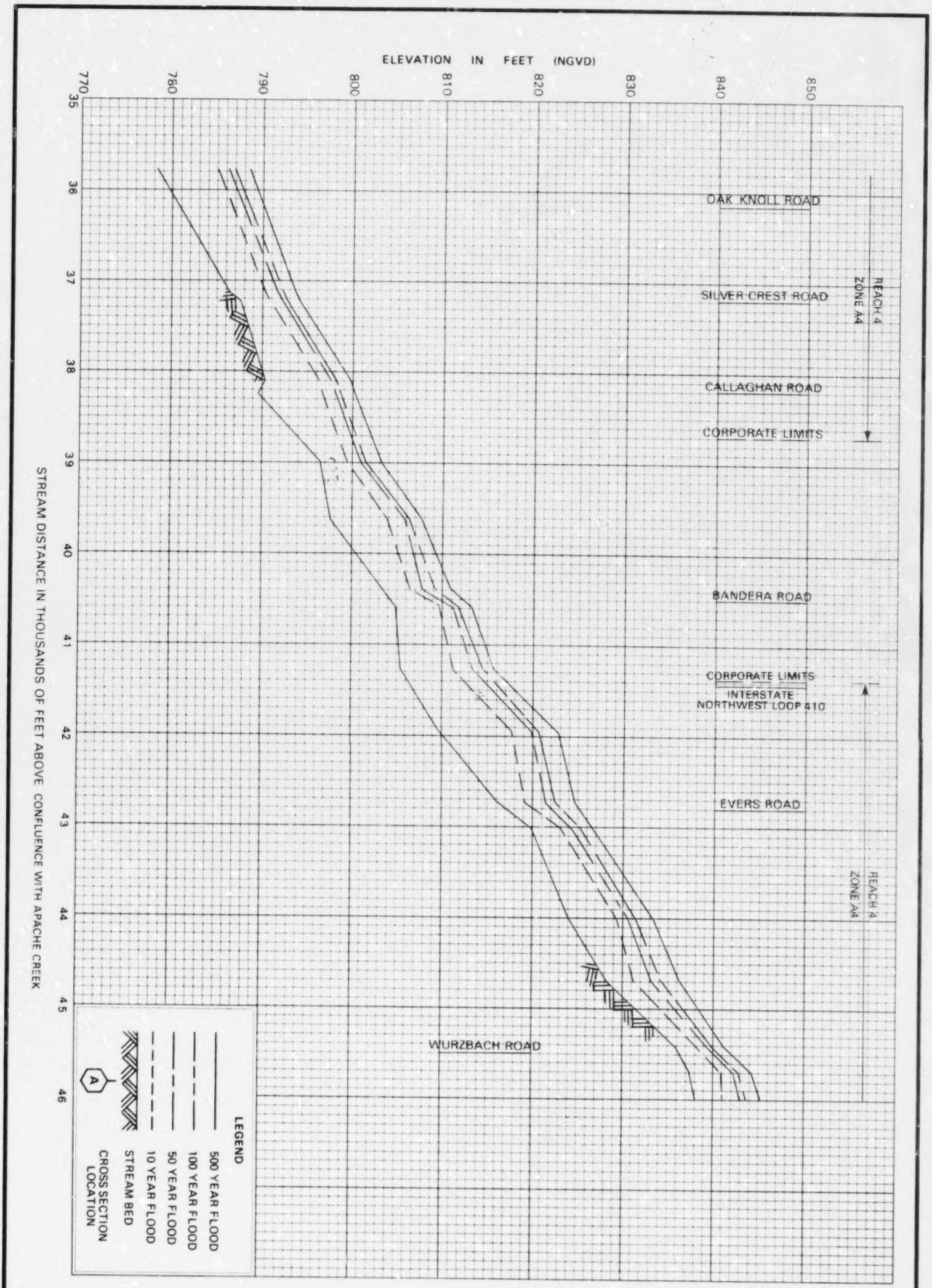

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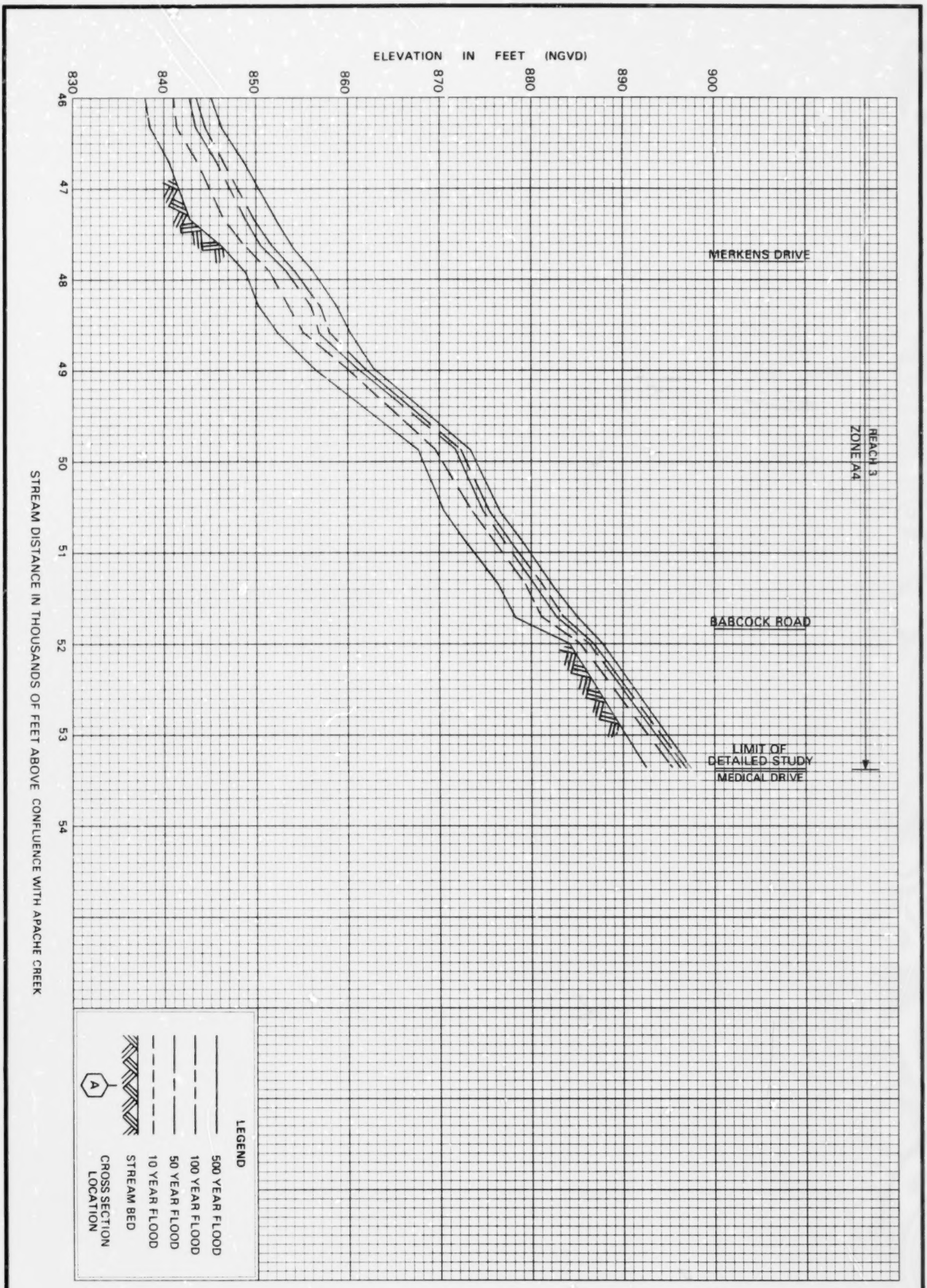

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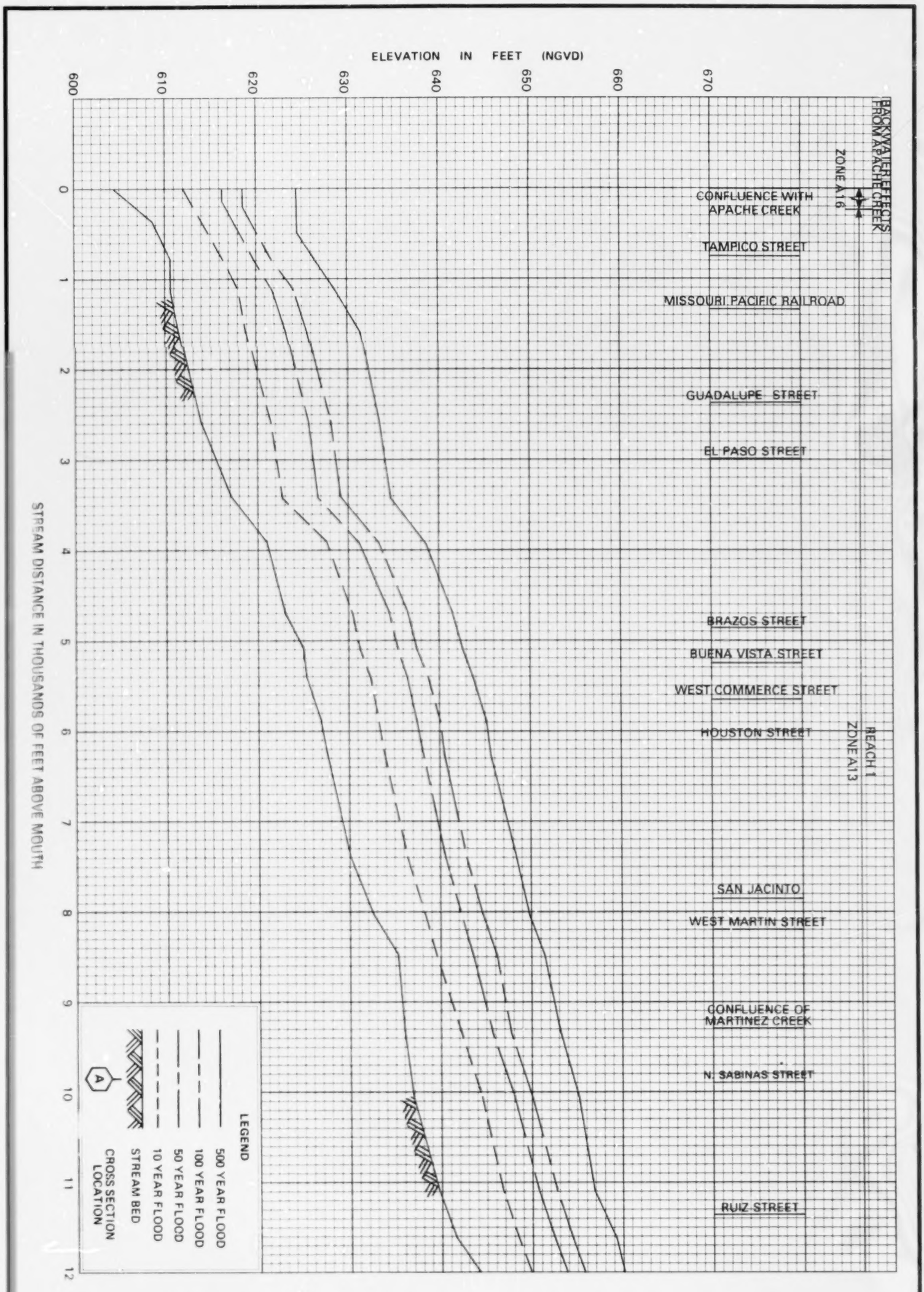

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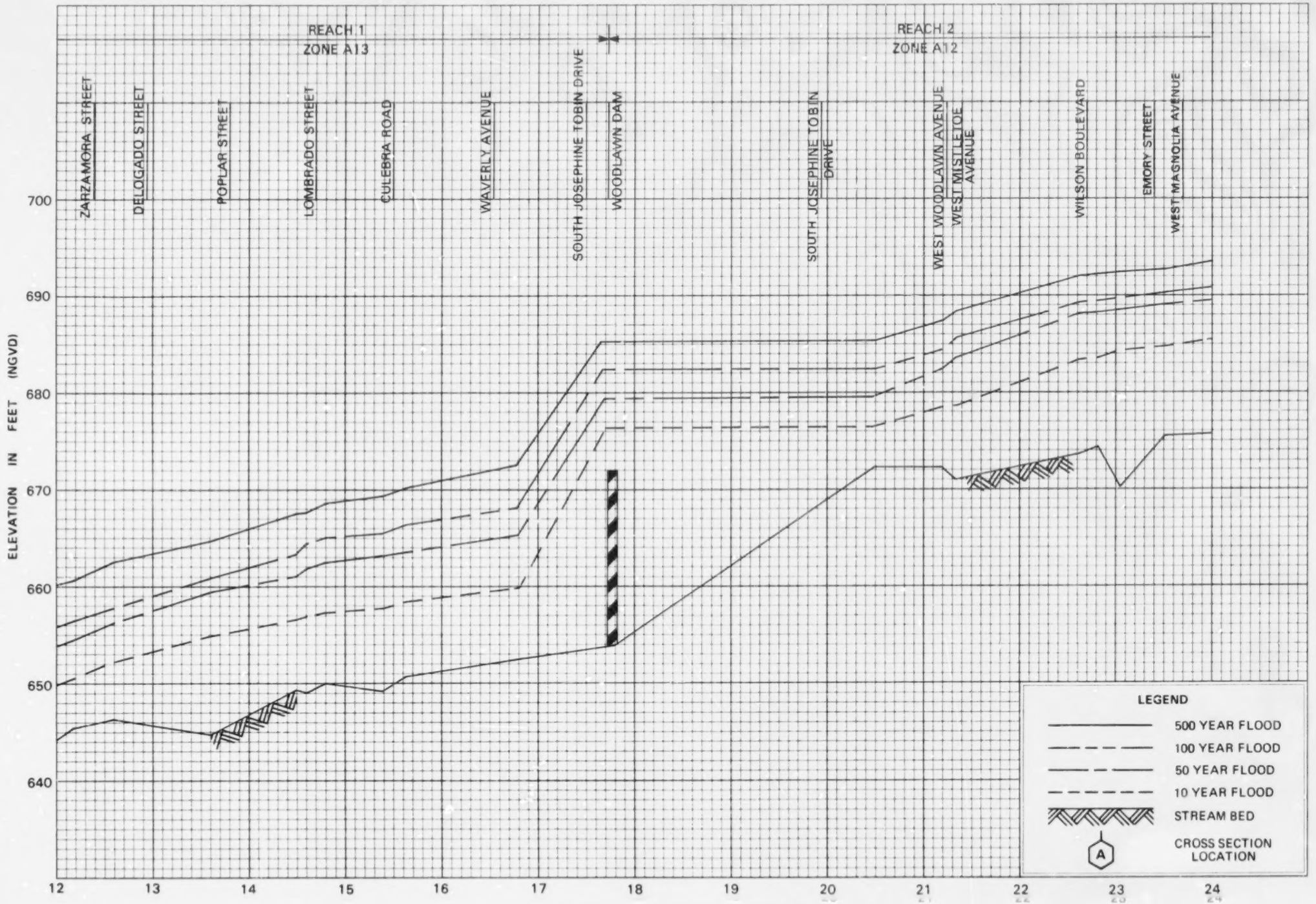
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

ALAZAN CREEK



FLOOD PROFILES

ALAZAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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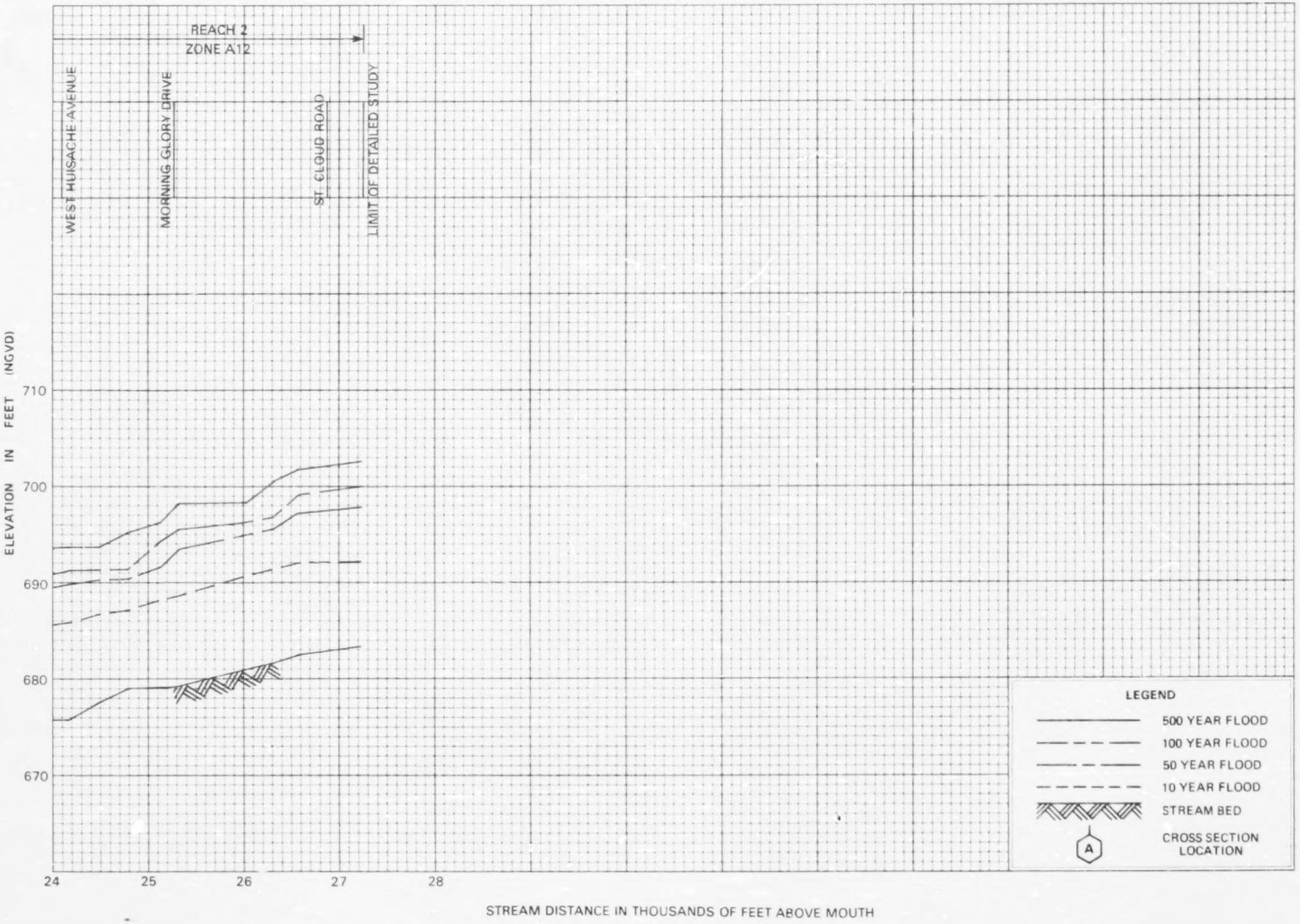

FLOOD PROFILES

ALAZAN CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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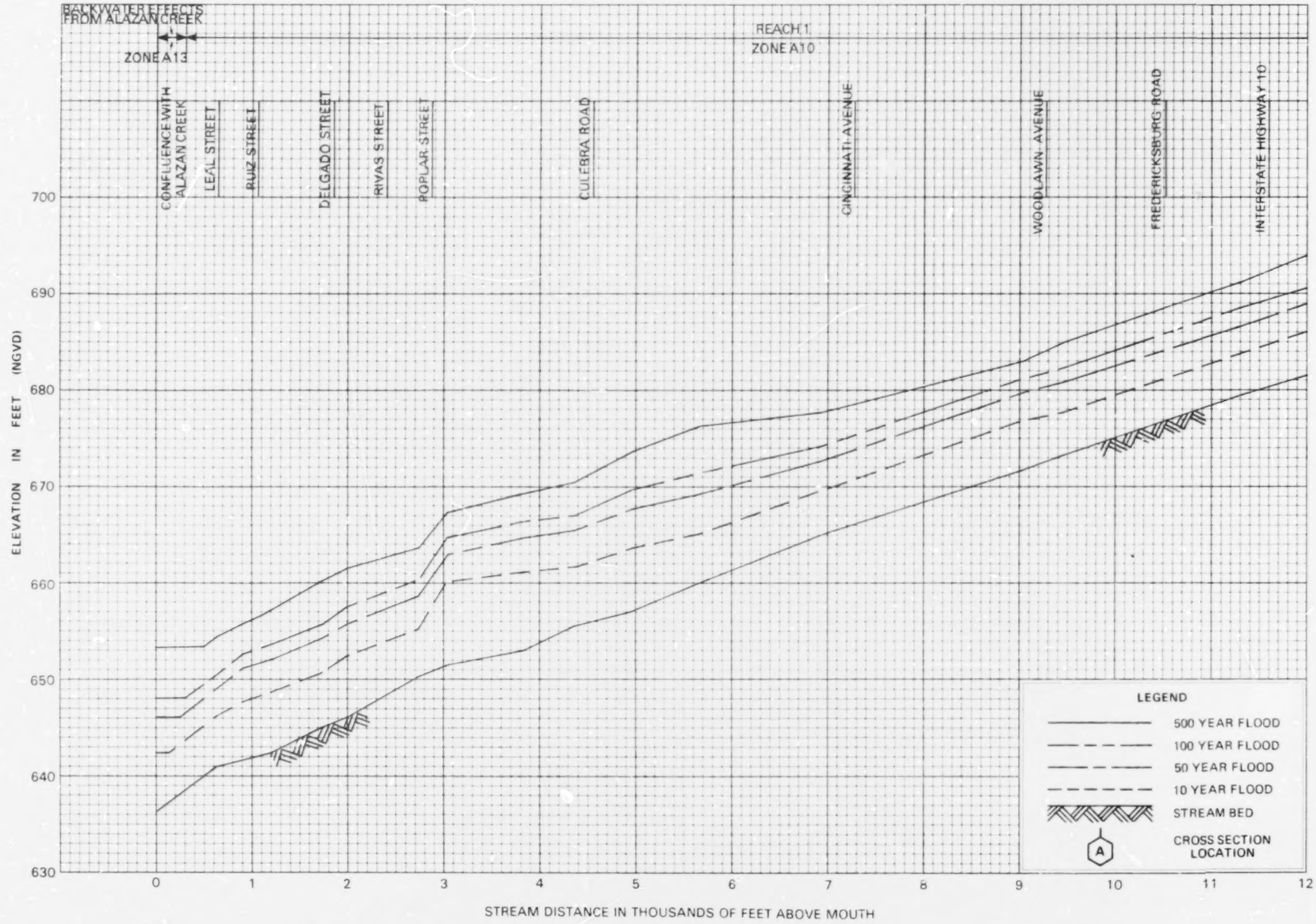

FLOOD PROFILES

MARTINEZ CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

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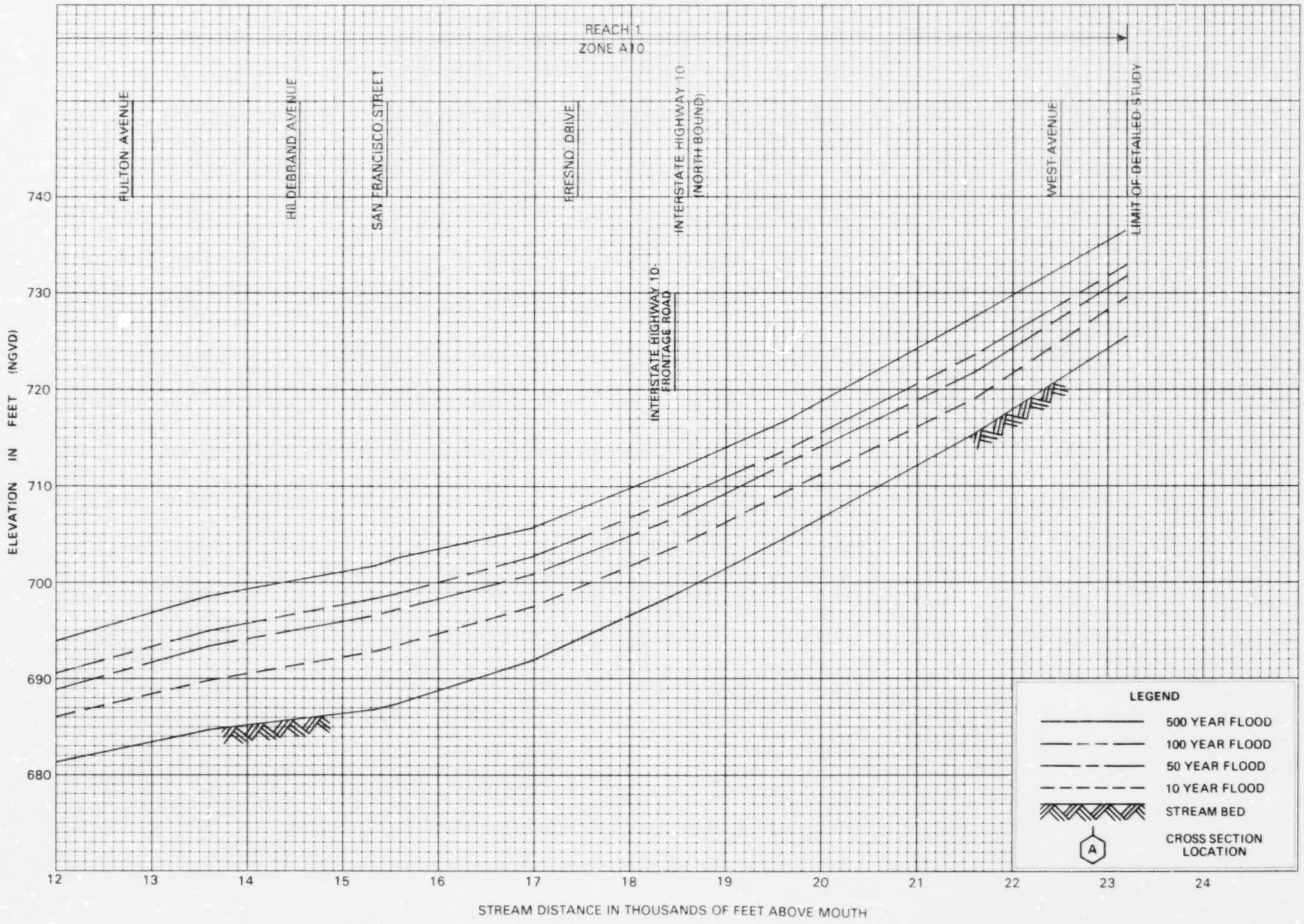

FLOOD PROFILES

MARTINEZ CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

31P

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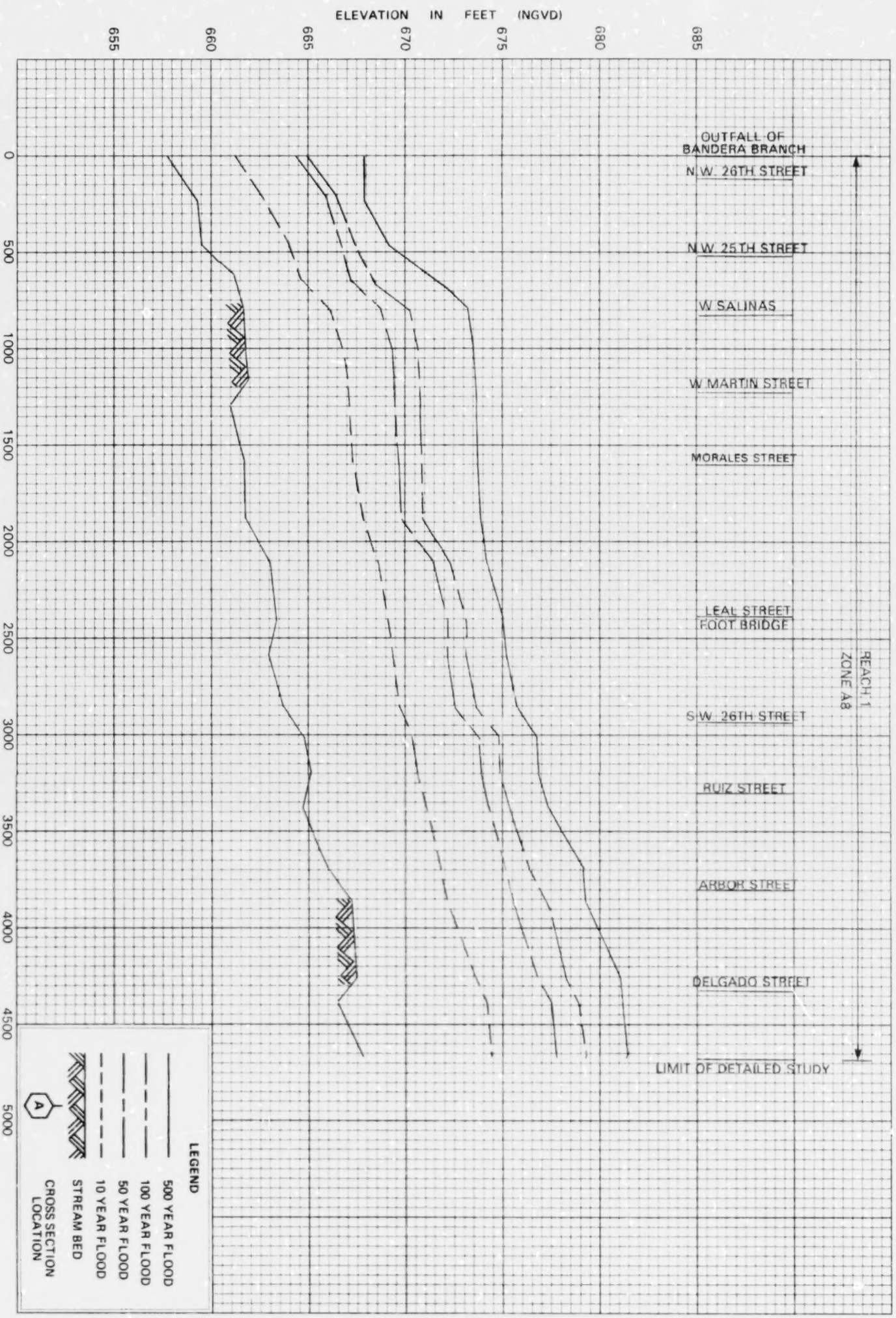

32P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES BANDERA BRANCH

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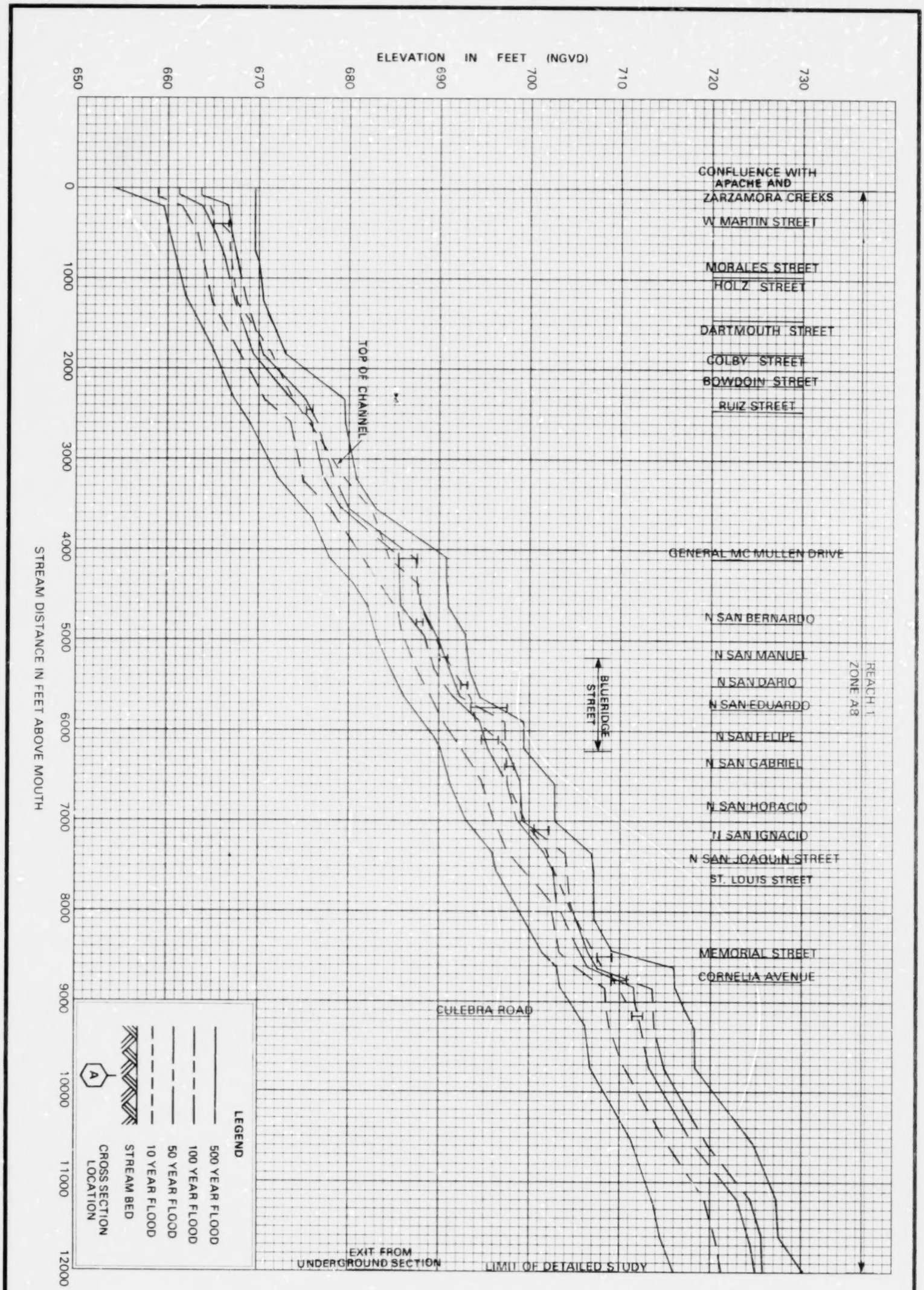

33P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF SAN ANTONIO, TX** (BEXAR CO.)	**FLOOD PROFILES** **UPPER APACHE CREEK**

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FLOOD PROFILES

TRIB A ZARZAMORA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

BEXAR CO.

34P

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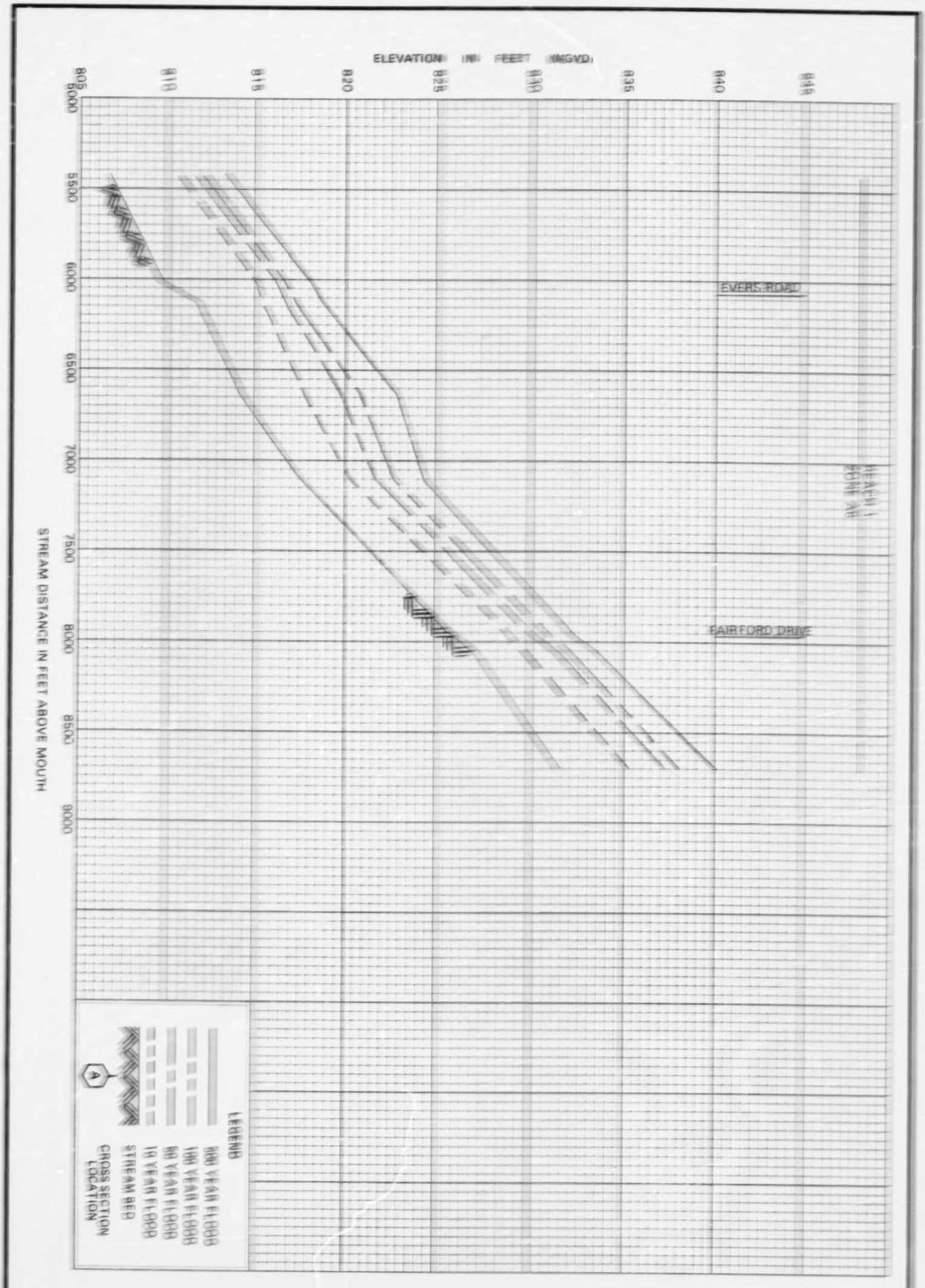


35P

FEDERAL EMERGENCY MANAGEMENT AGENCY

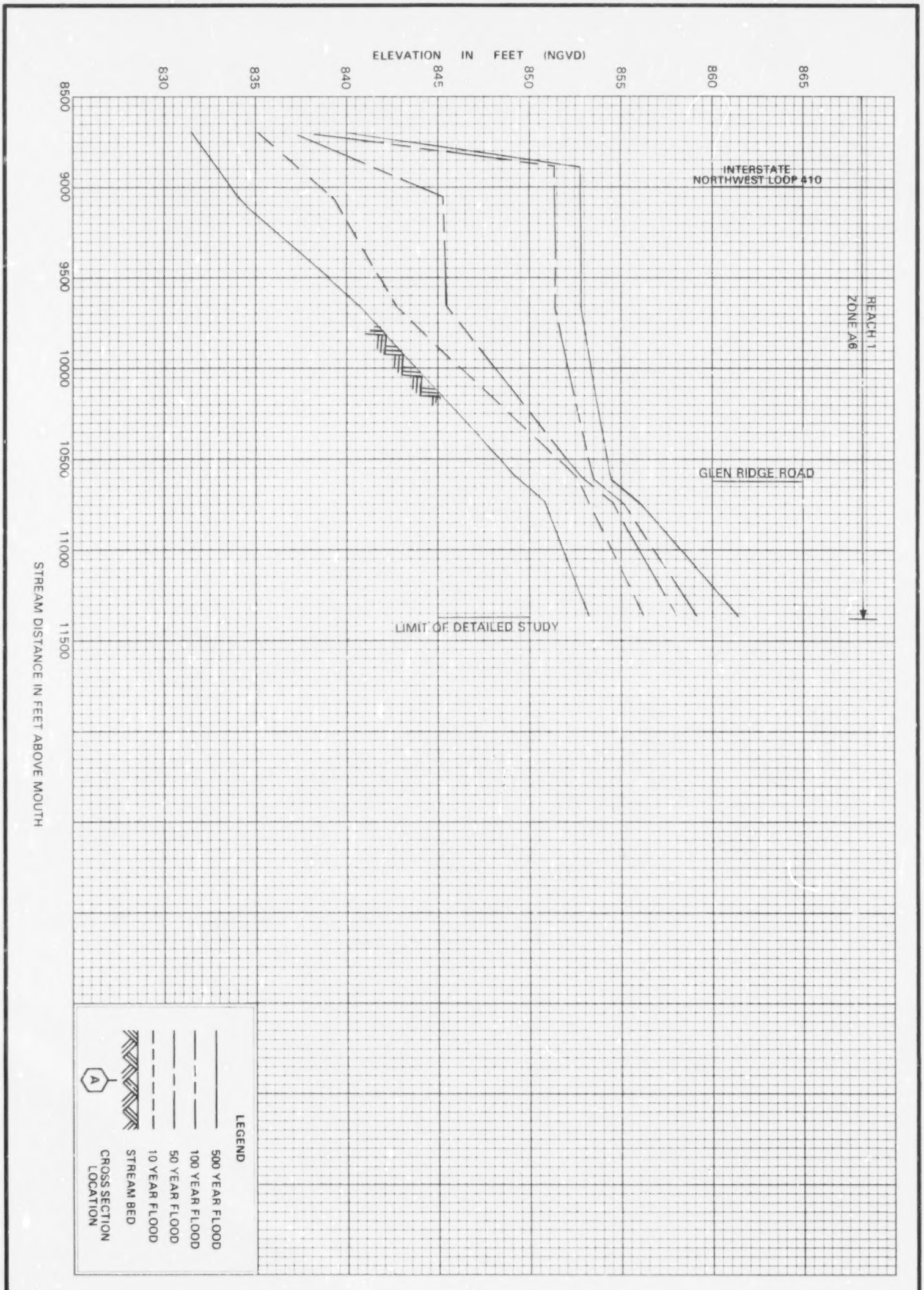
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

TRIB A ZARZAMORA CREEK

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

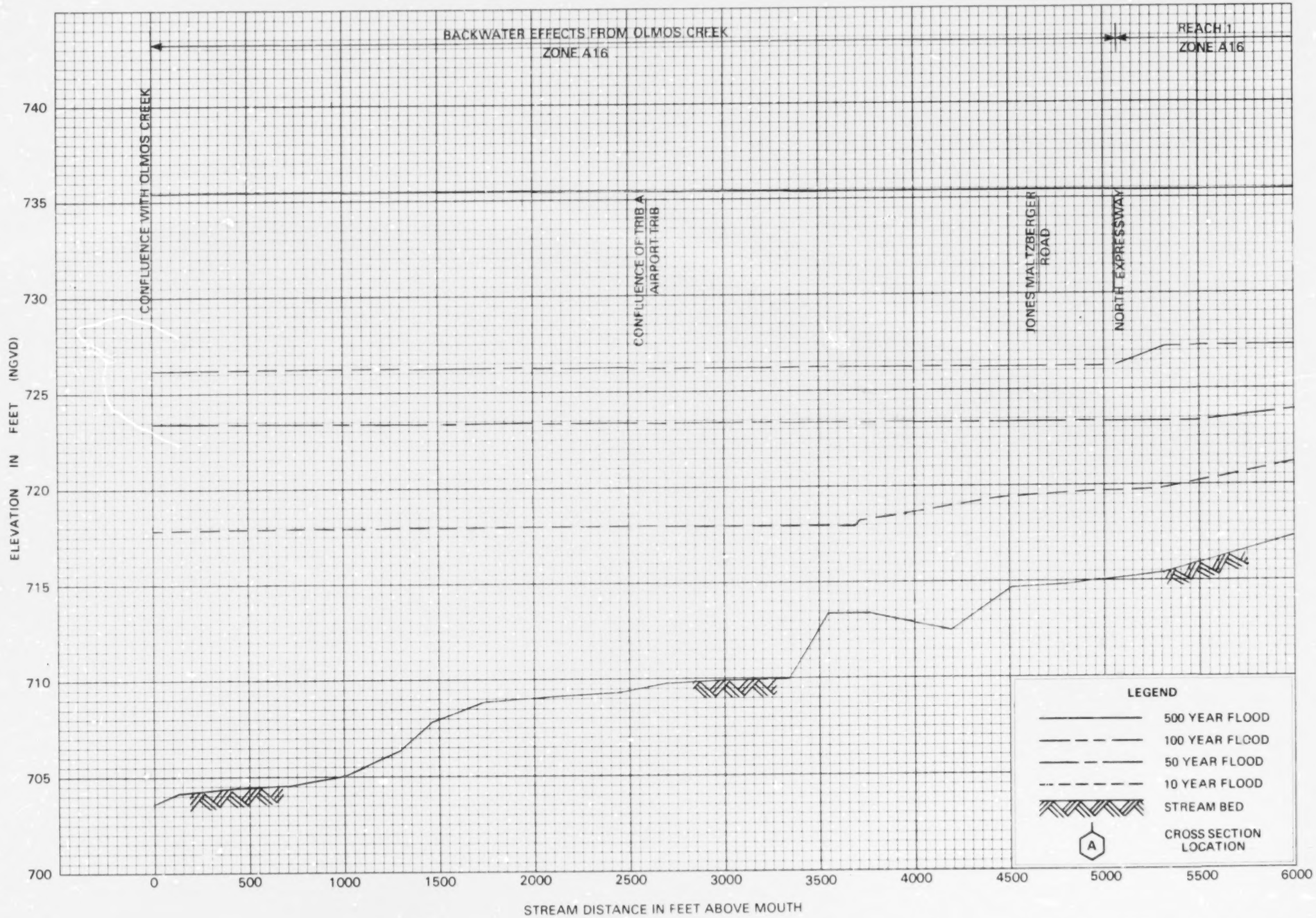
CITY OF SAN ANTONIO, TX
(BEXAR CO.)

FLOOD PROFILES

TRIB A ZARZAMORA CREEK

36P

BEST COPY AVAILABLE



FLOOD PROFILES

AIRPORT TRIB

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

37P

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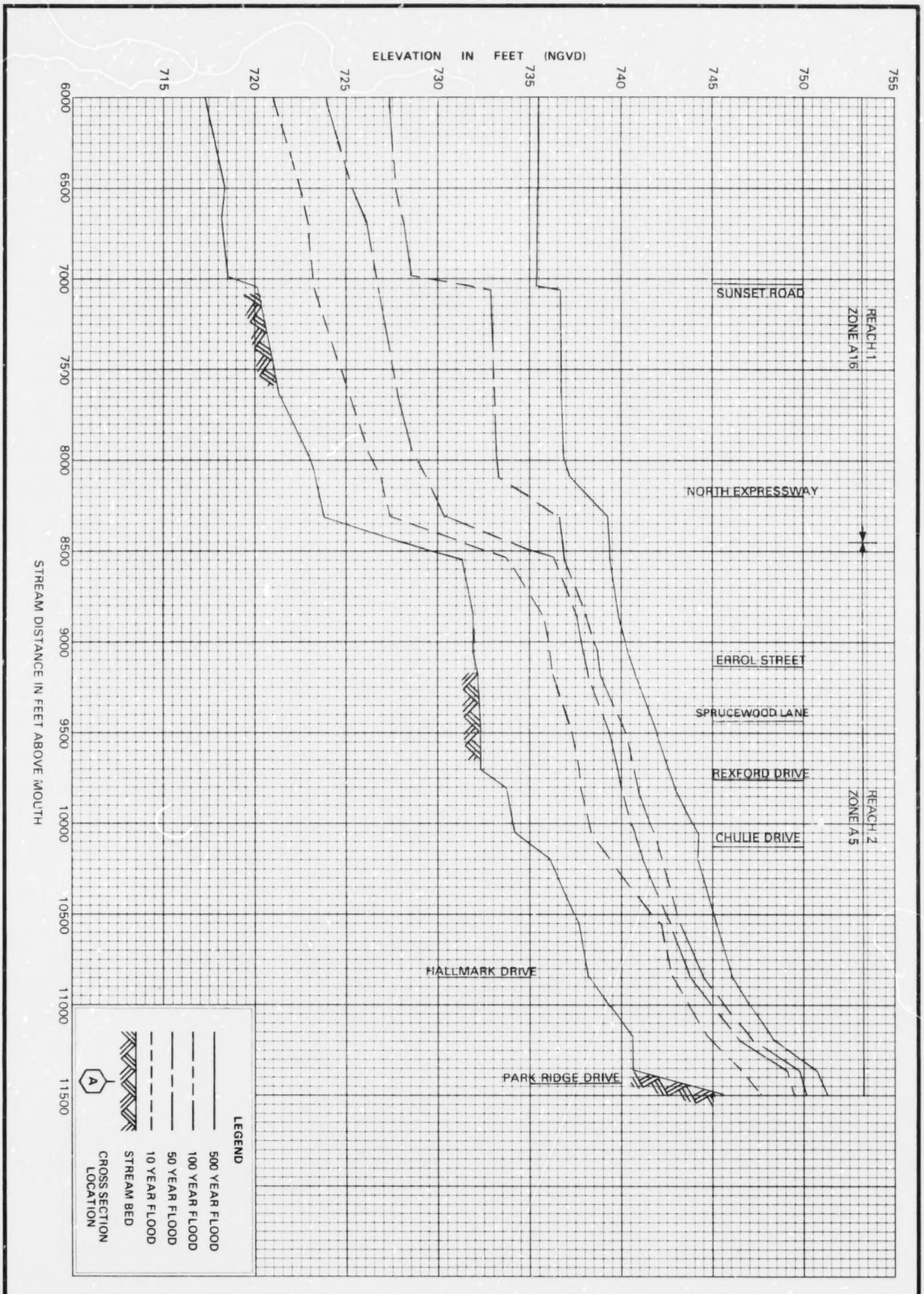

38P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

AIRPORT TRIB

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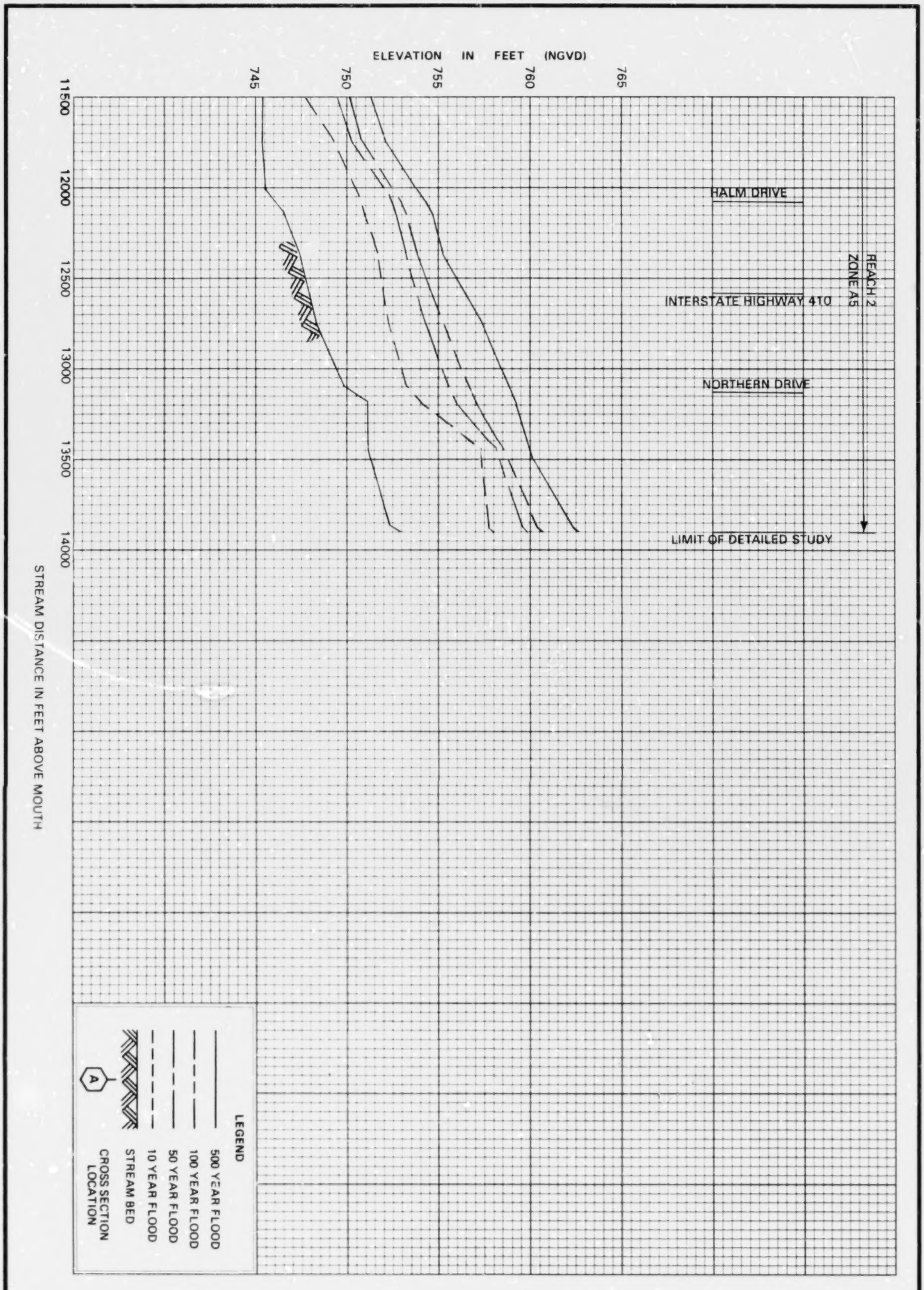


FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

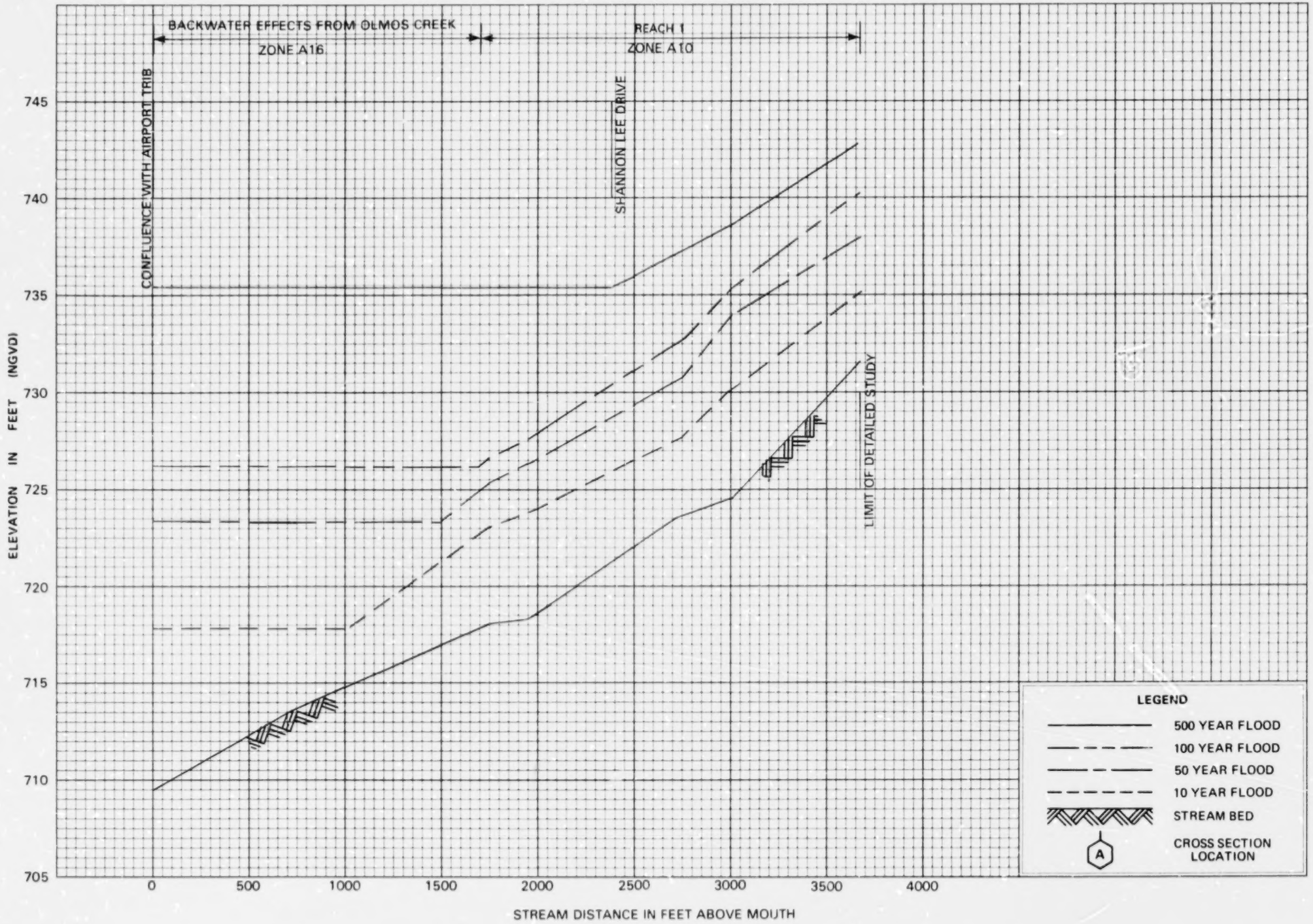
(BEXAR CO.)

39P

FLOOD PROFILES

AIRPORT TRIB

BEST COPY AVAILABLE



FLOOD PROFILES

TRIB A OF AIRPORT TRIB

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

40P

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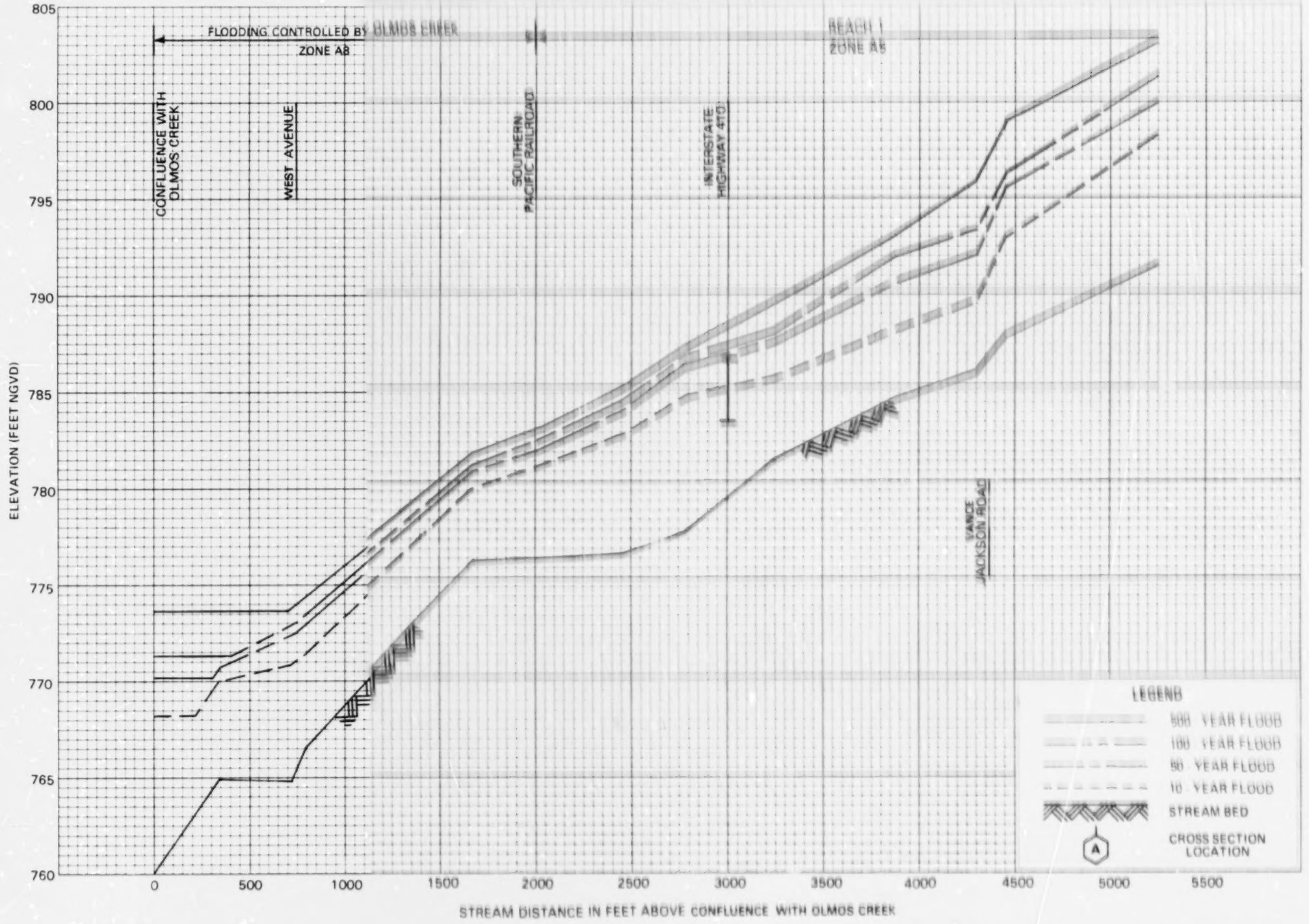

FLOOD PROFILES

ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

41P

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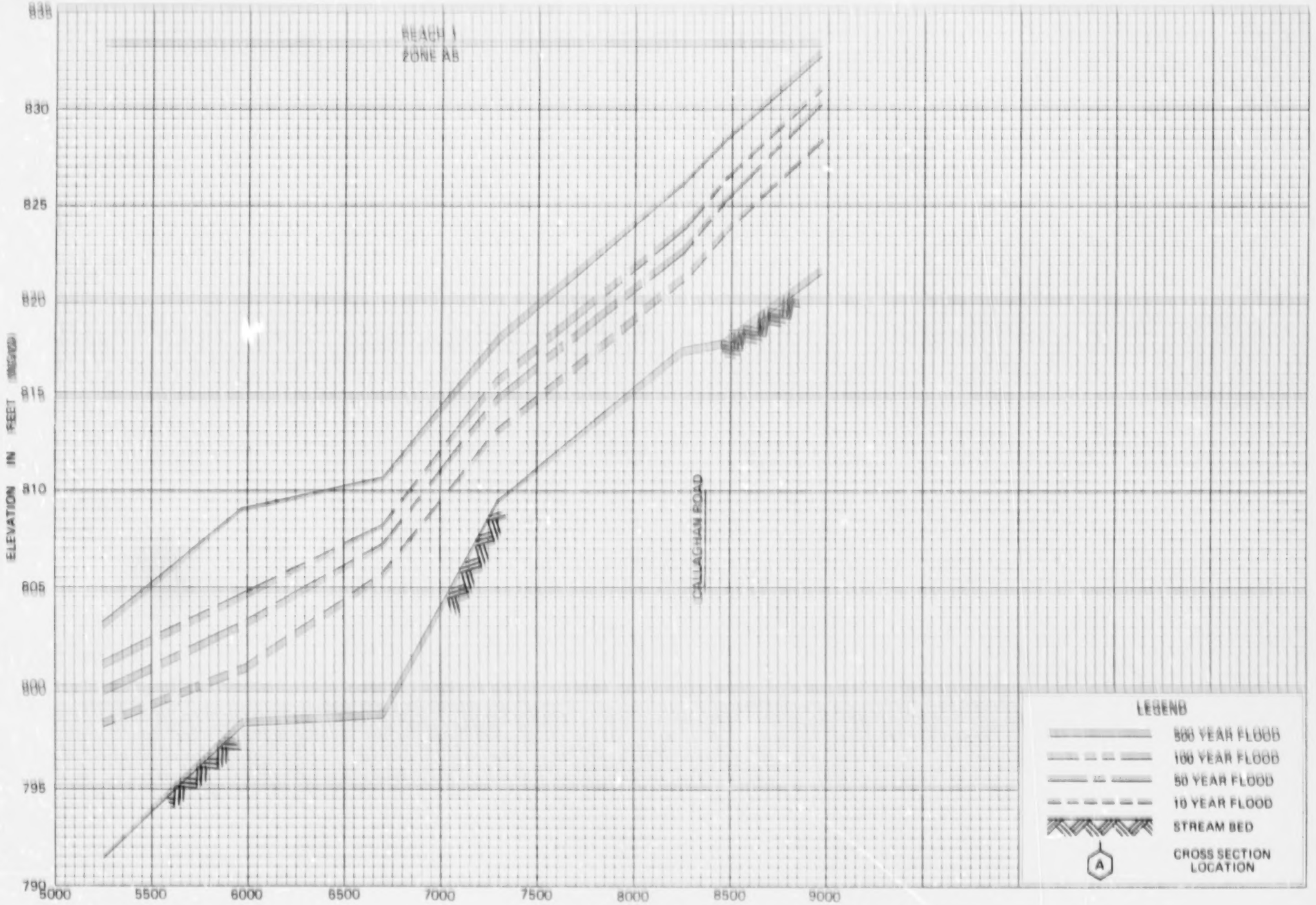

FLOOD PROFILES

ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

42P

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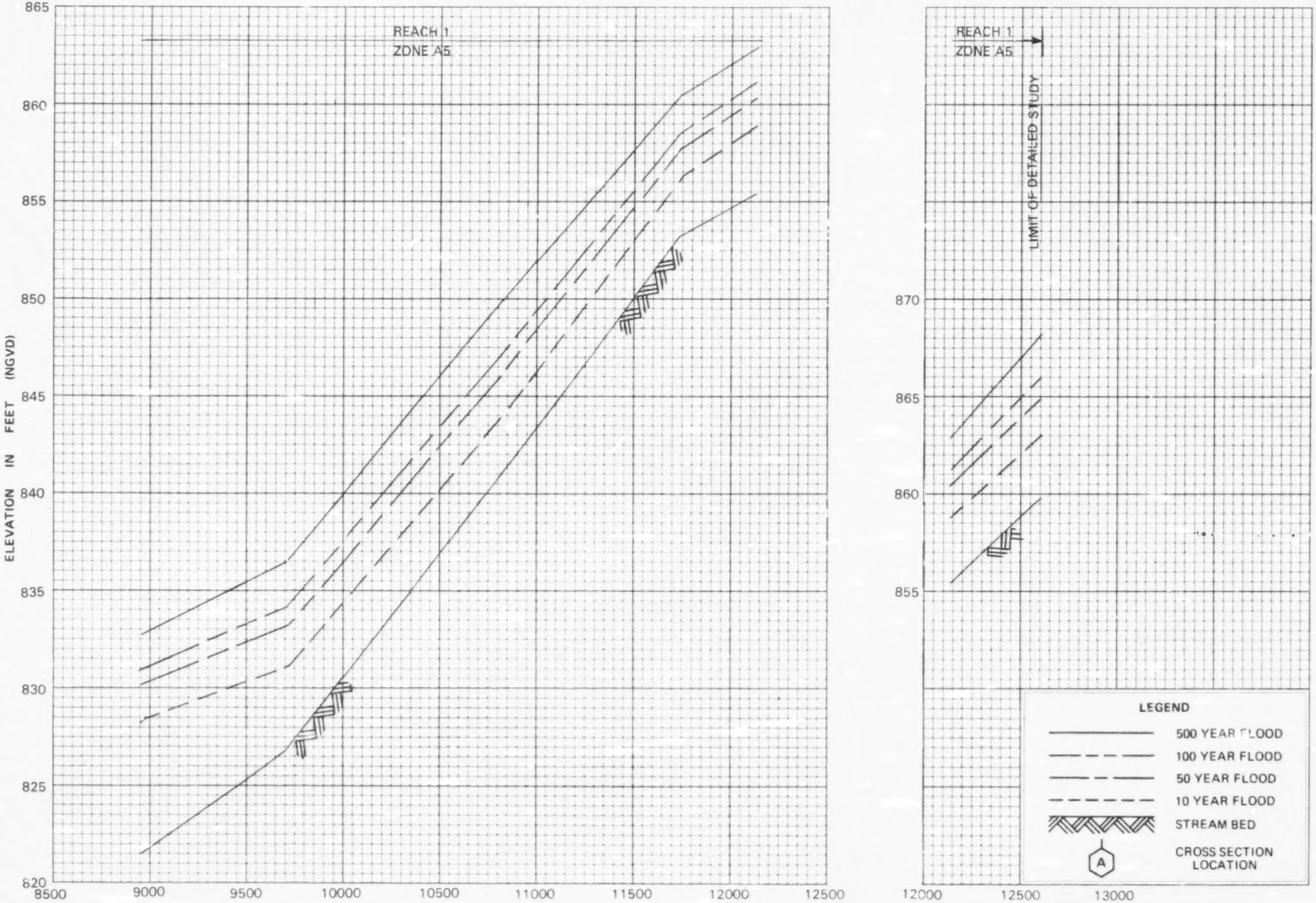

FLOOD PROFILES

ROCK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

43P

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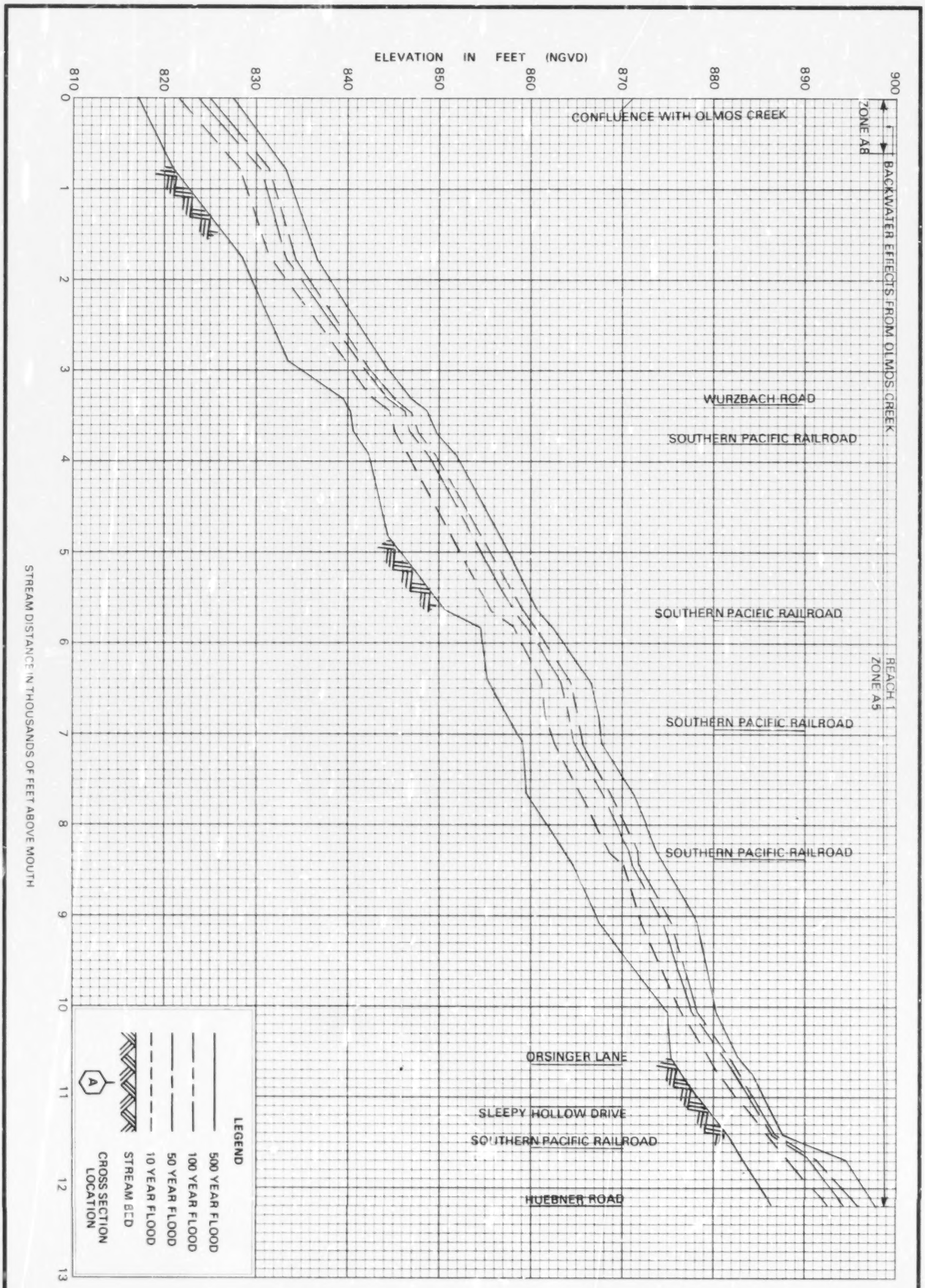
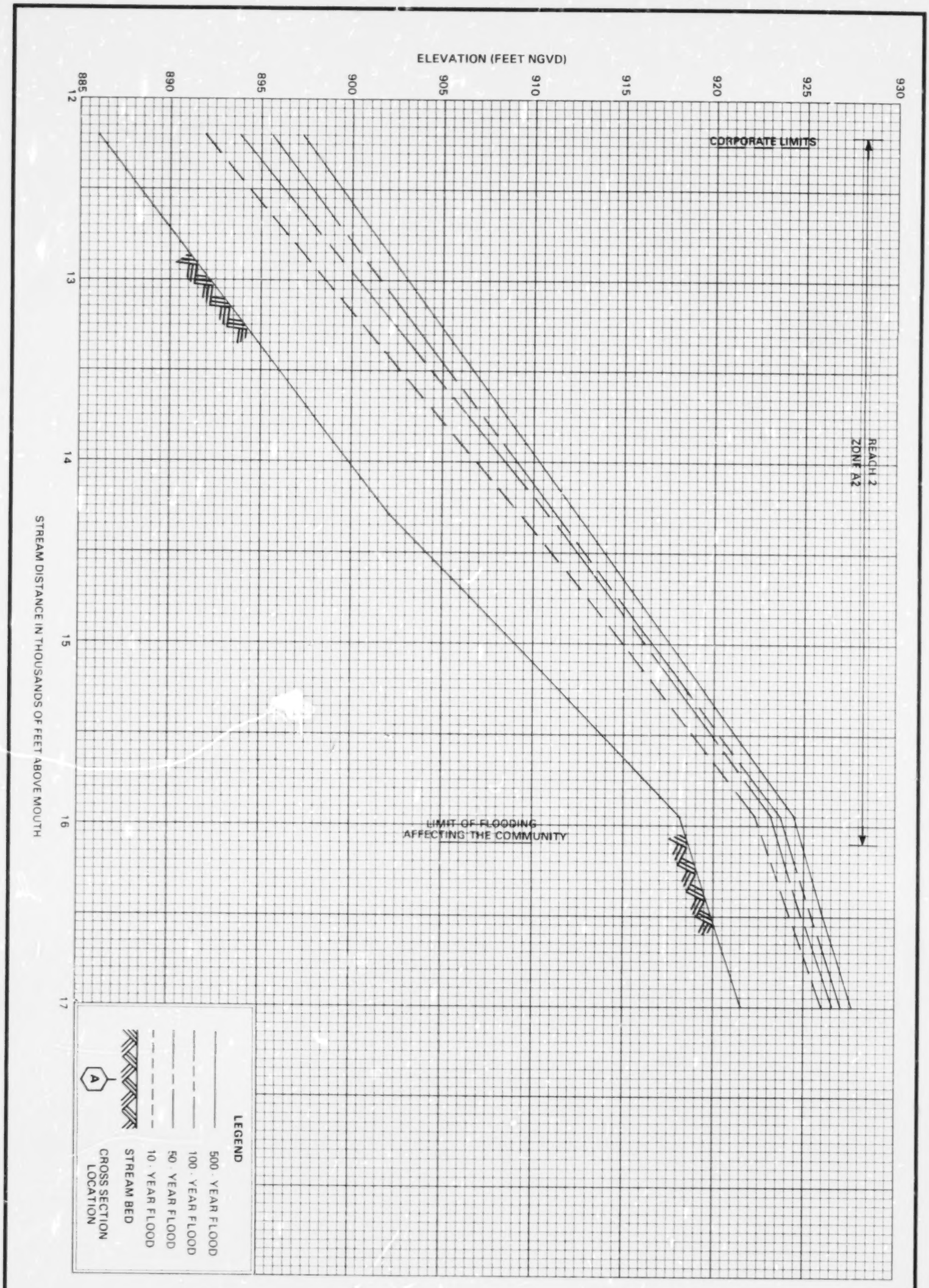


44P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES WEST FORK OLMOS CREEK

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

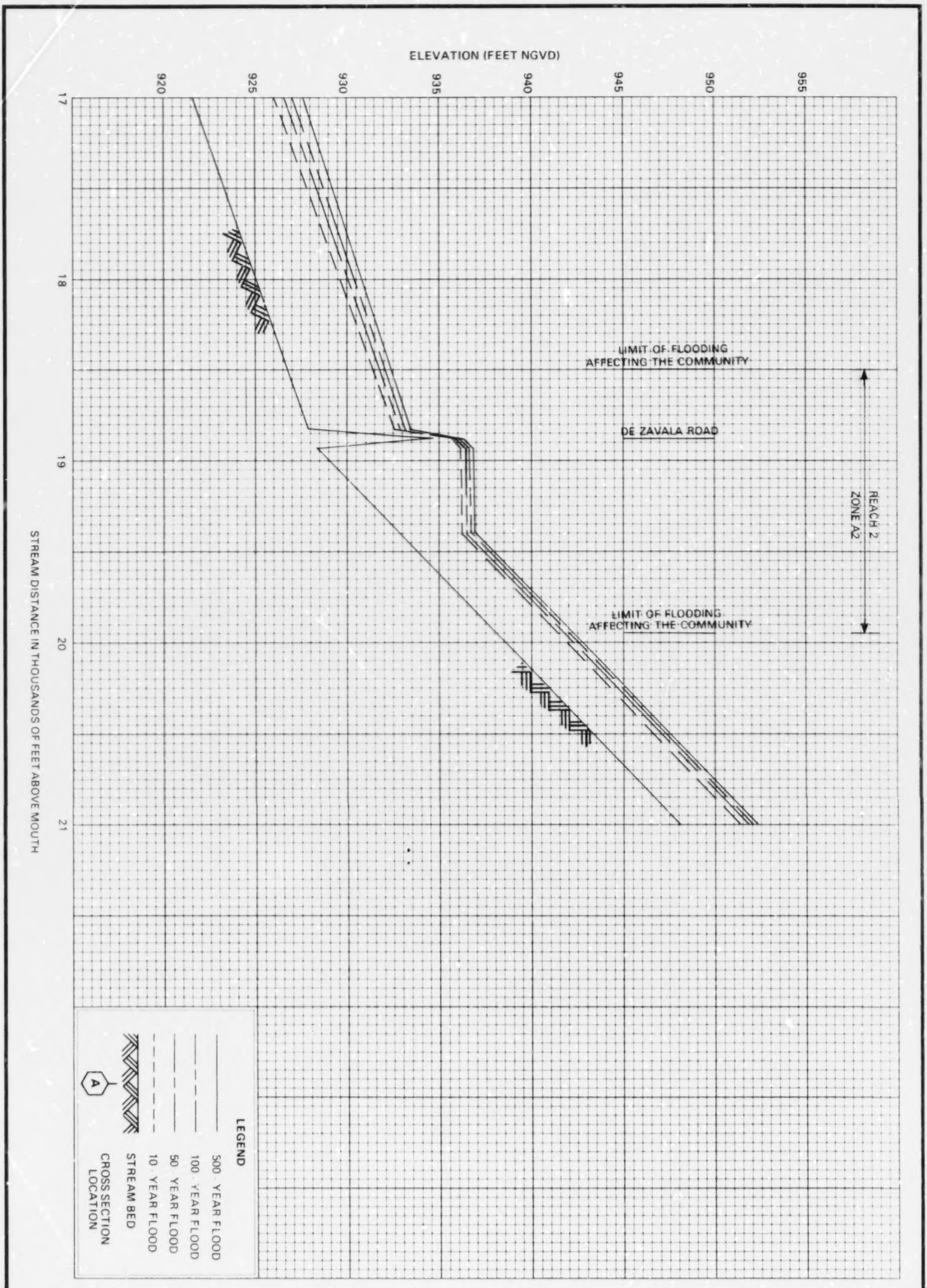
(BEXAR CO.)

FLOOD PROFILES

WEST FORK OLMOS CREEK

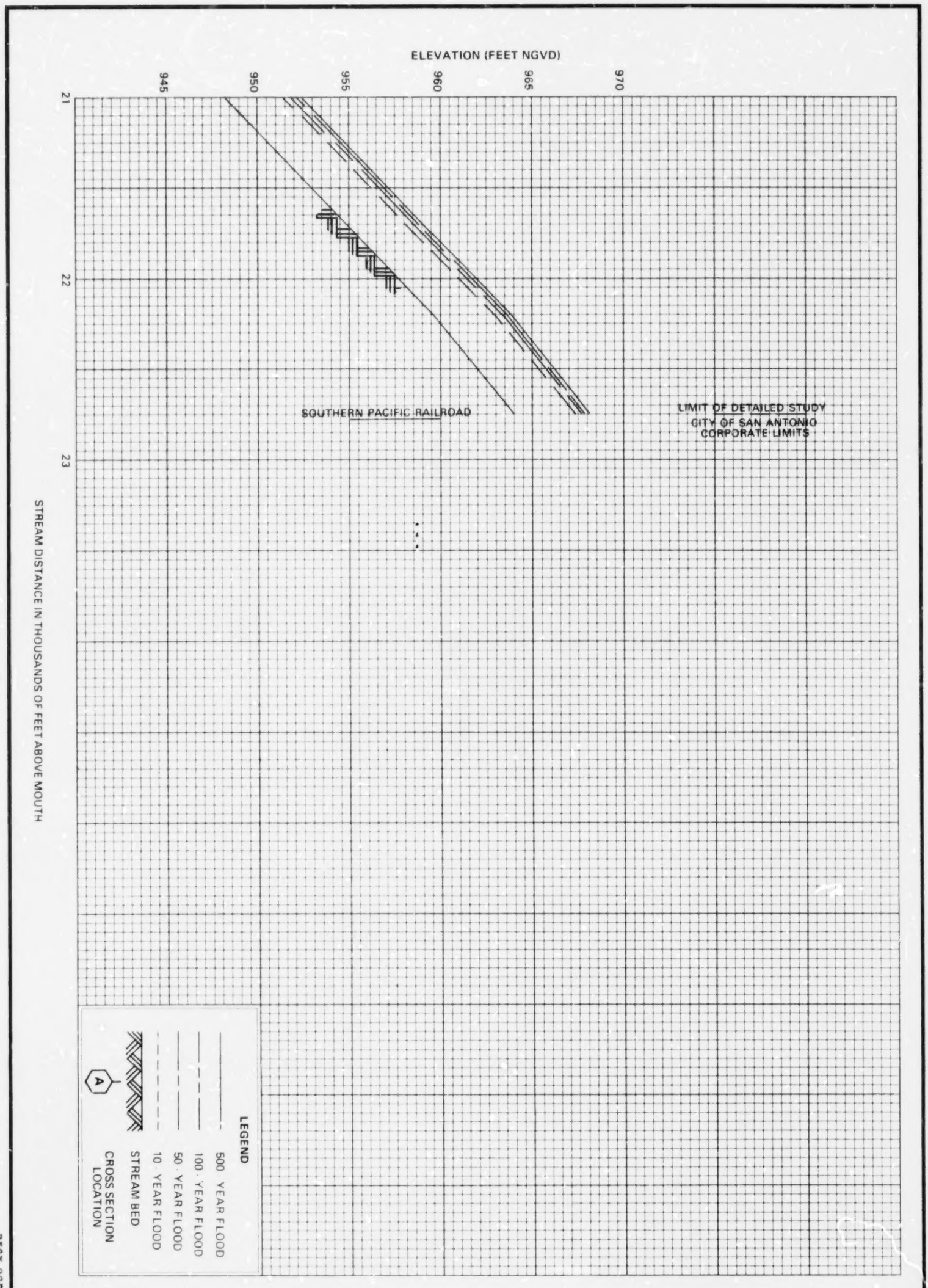
45P

BEST COPY AVAILABLE



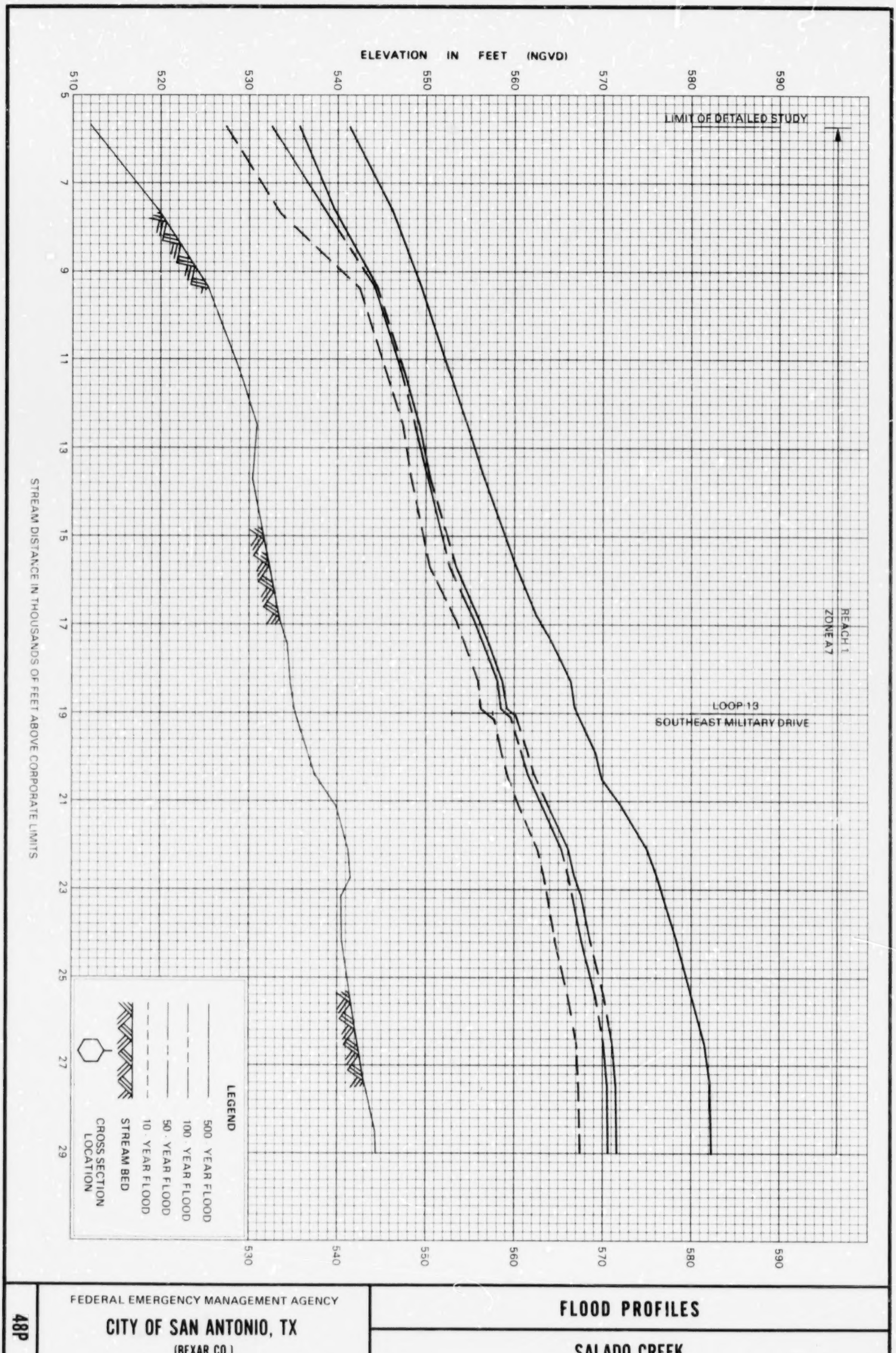
46P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES WEST FORK OLMOS CREEK

BEST COPY AVAILABLE



47P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF SAN ANTONIO, TX** (BEXAR CO.)	**FLOOD PROFILES** **WEST FORK OLMOS CREEK**

BEST COPY AVAILABLE



48P

FEDERAL EMERGENCY MANAGEMENT AGENCY

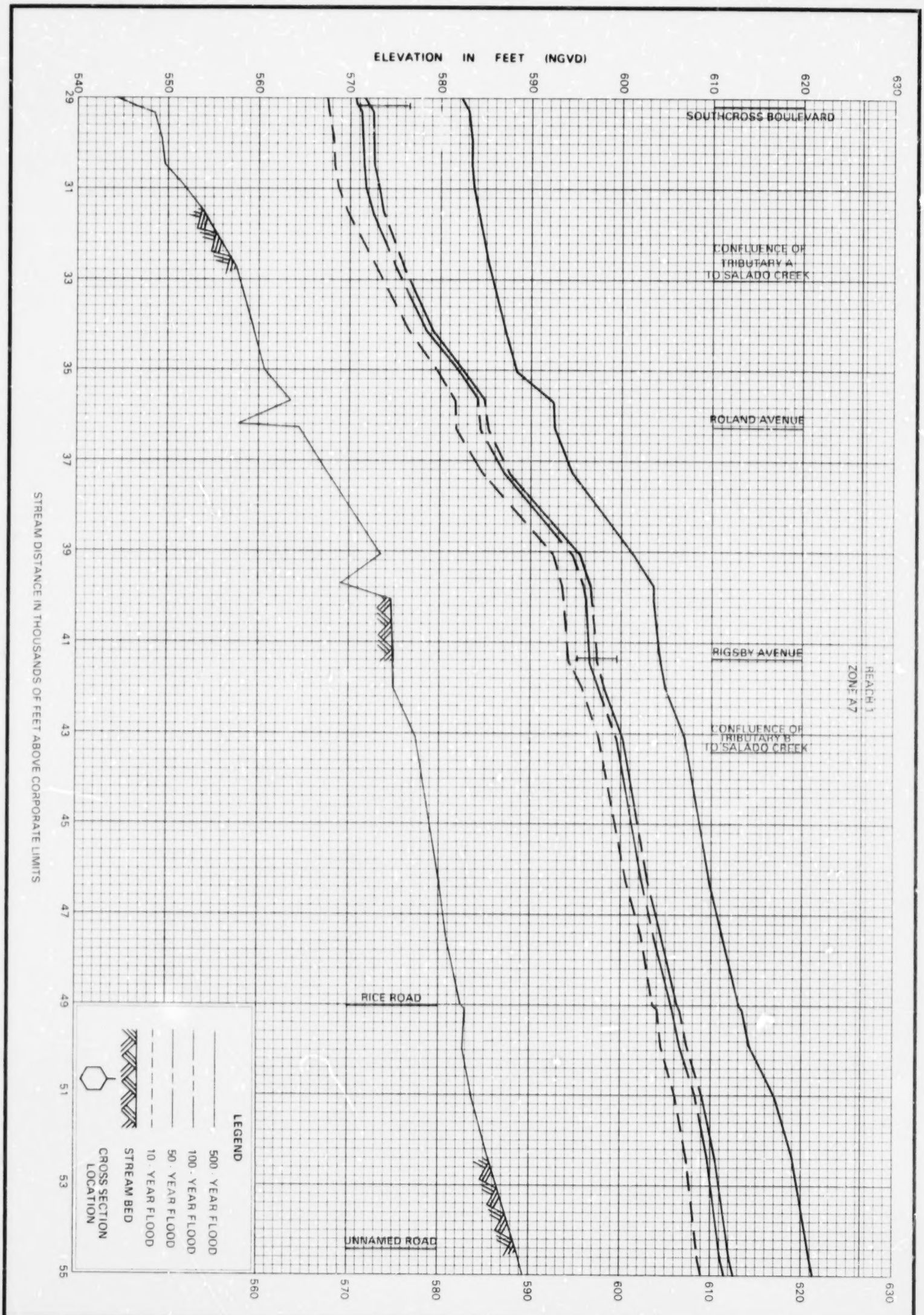
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

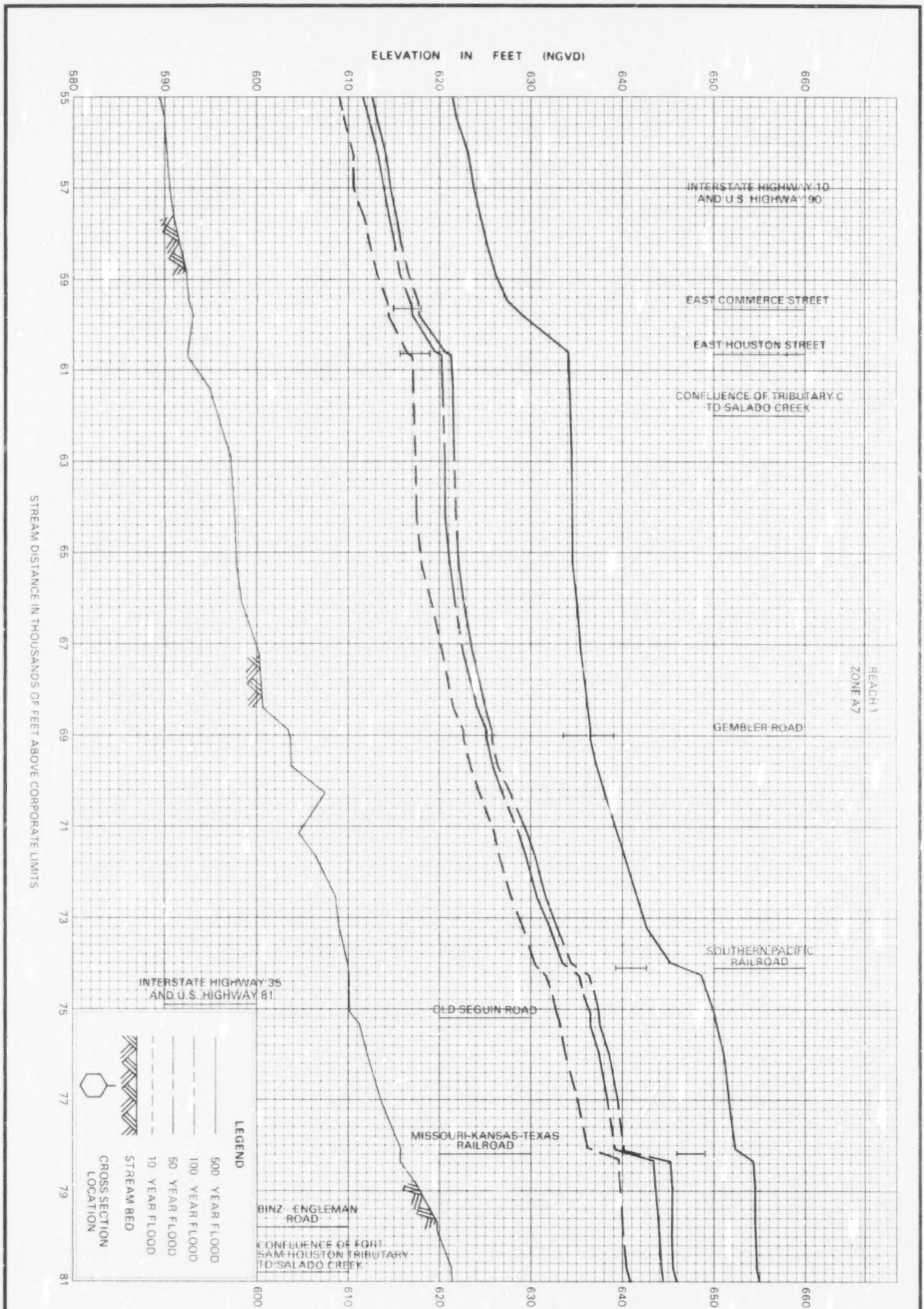
(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

49P

BEST COPY AVAILABLE



50P

FEDERAL EMERGENCY MANAGEMENT AGENCY

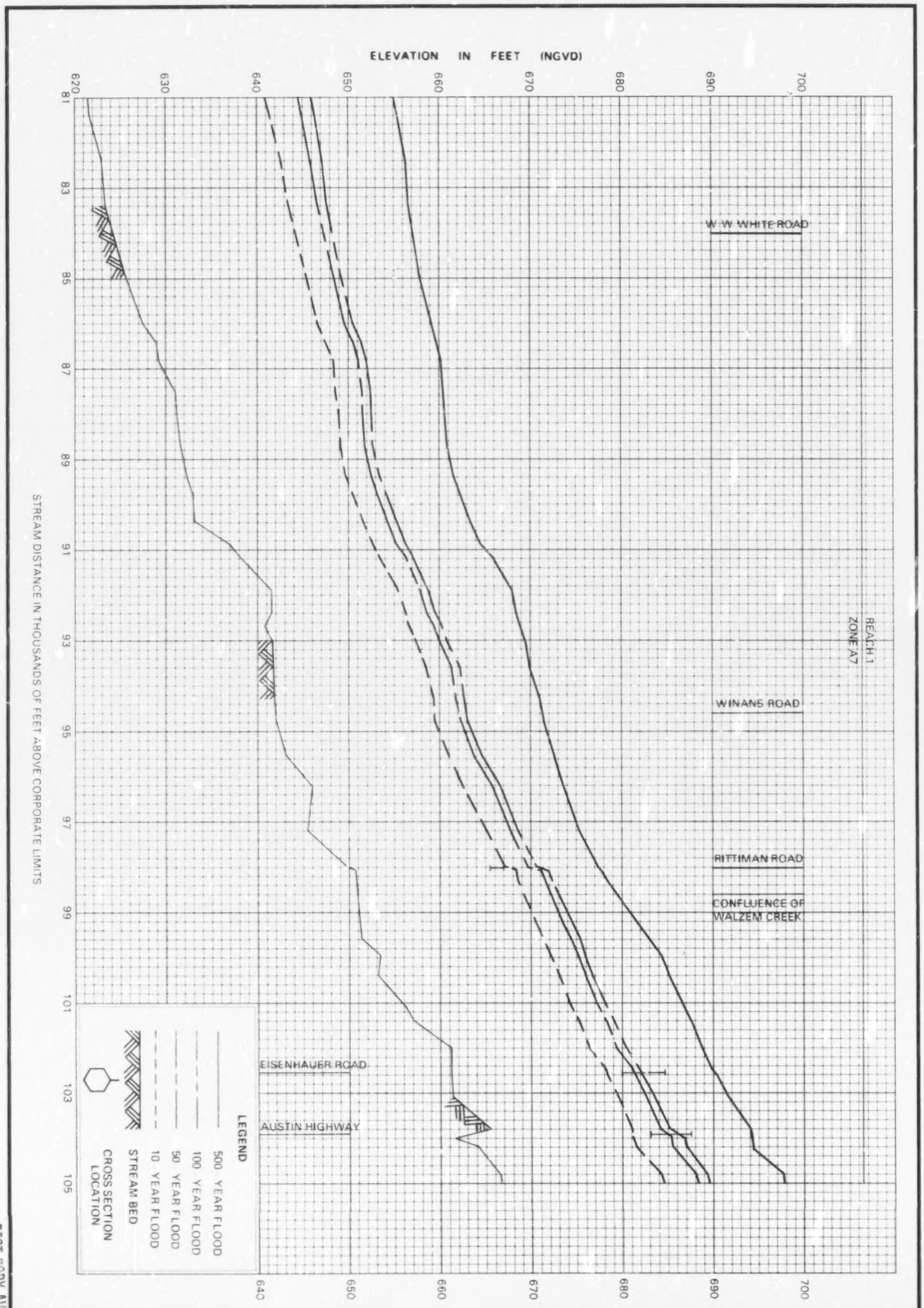
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

51P

87

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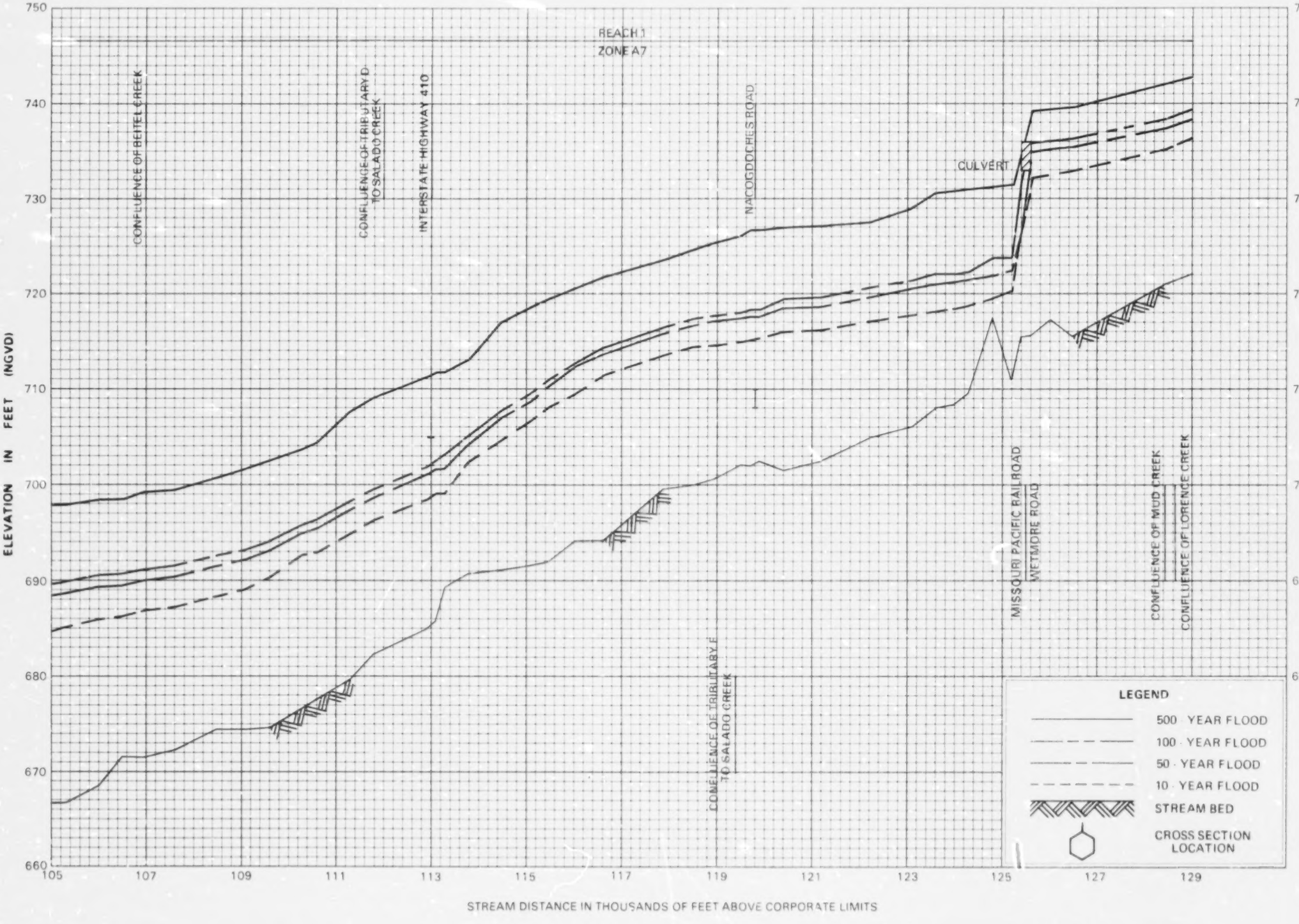

FLOOD PROFILES

SALADO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

52P

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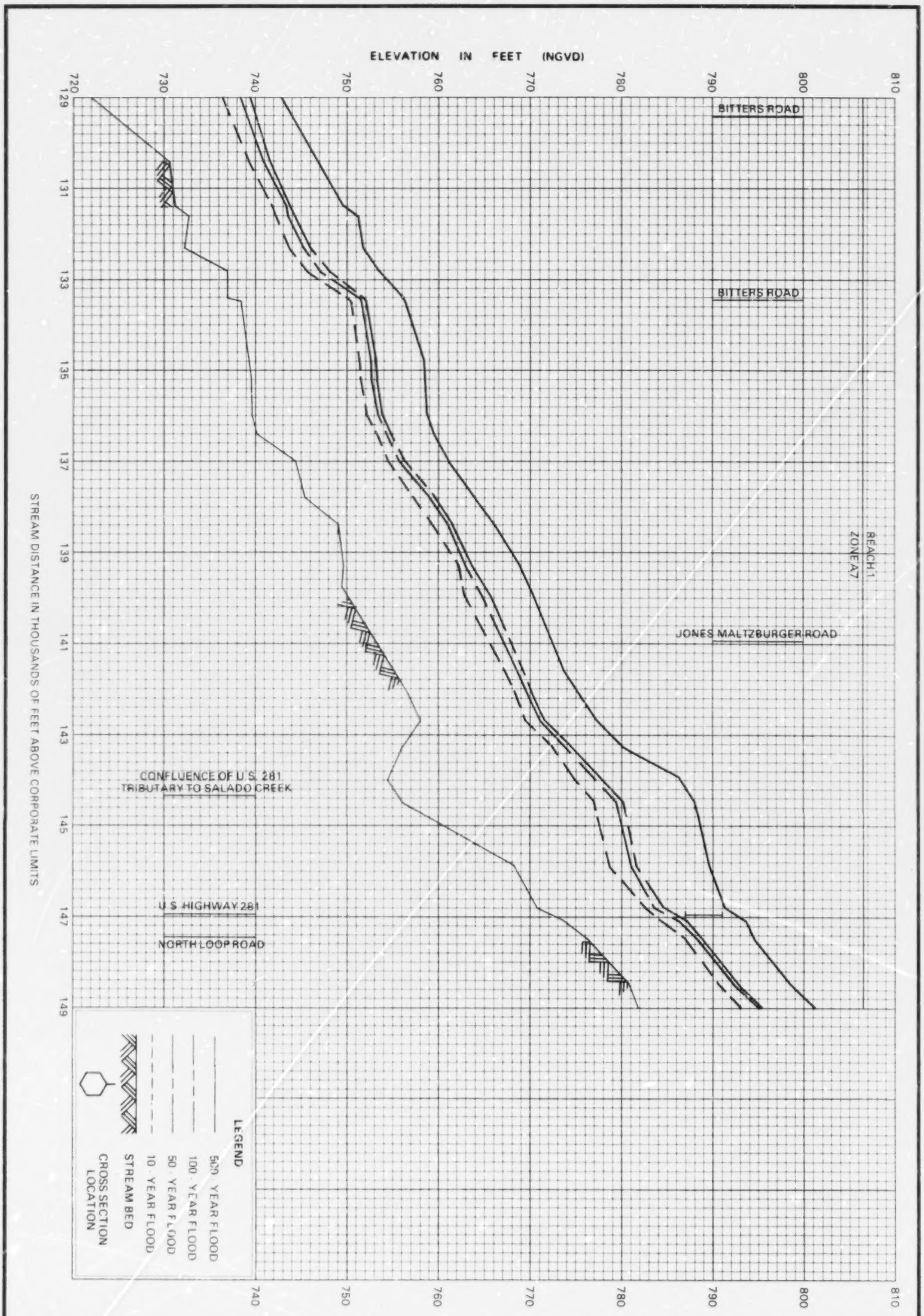


53P

FEDERAL EMERGENCY MANAGEMENT AGENCY

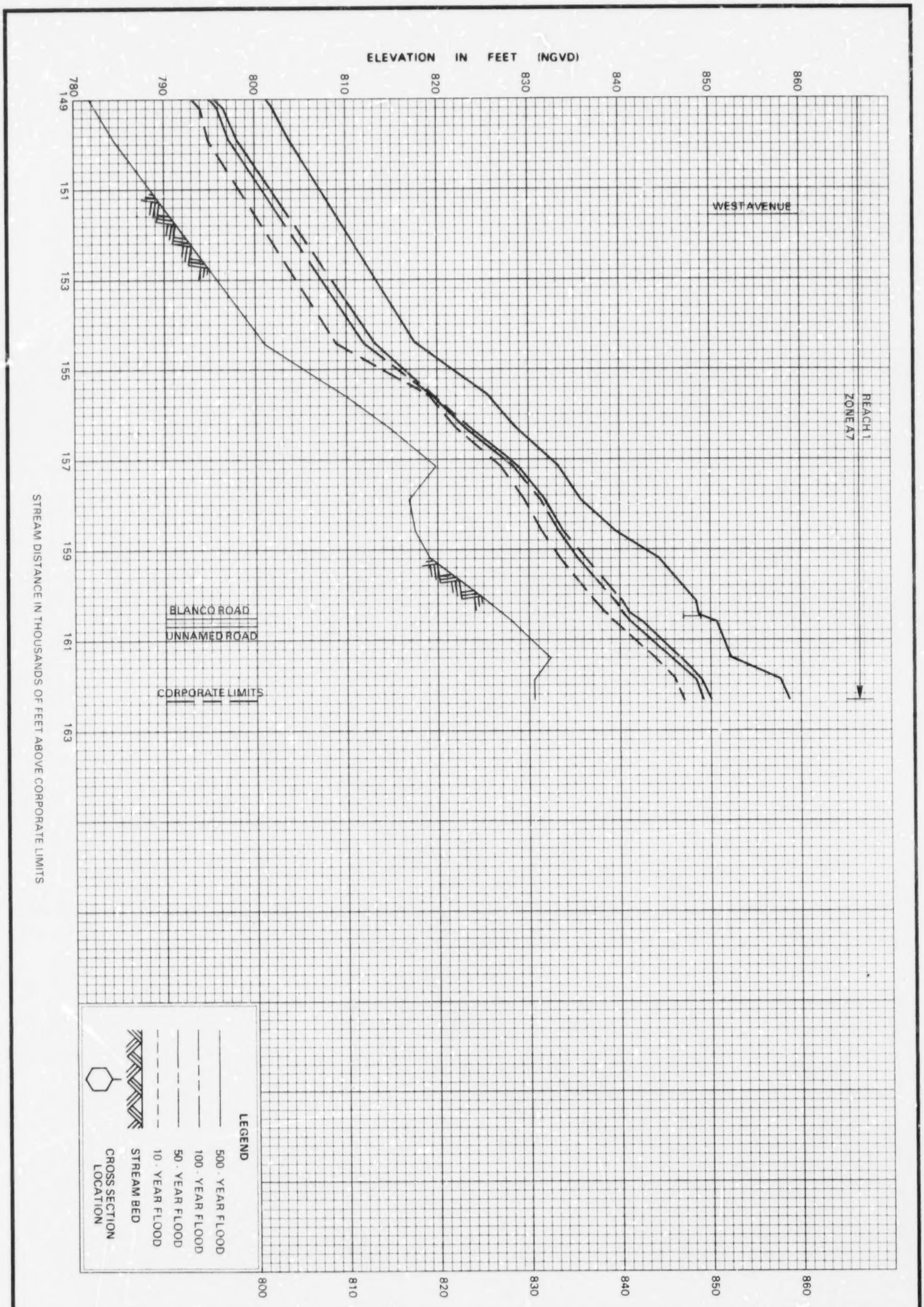
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

BEST COPY AVAILABLE



54P

FEDERAL EMERGENCY MANAGEMENT AGENCY

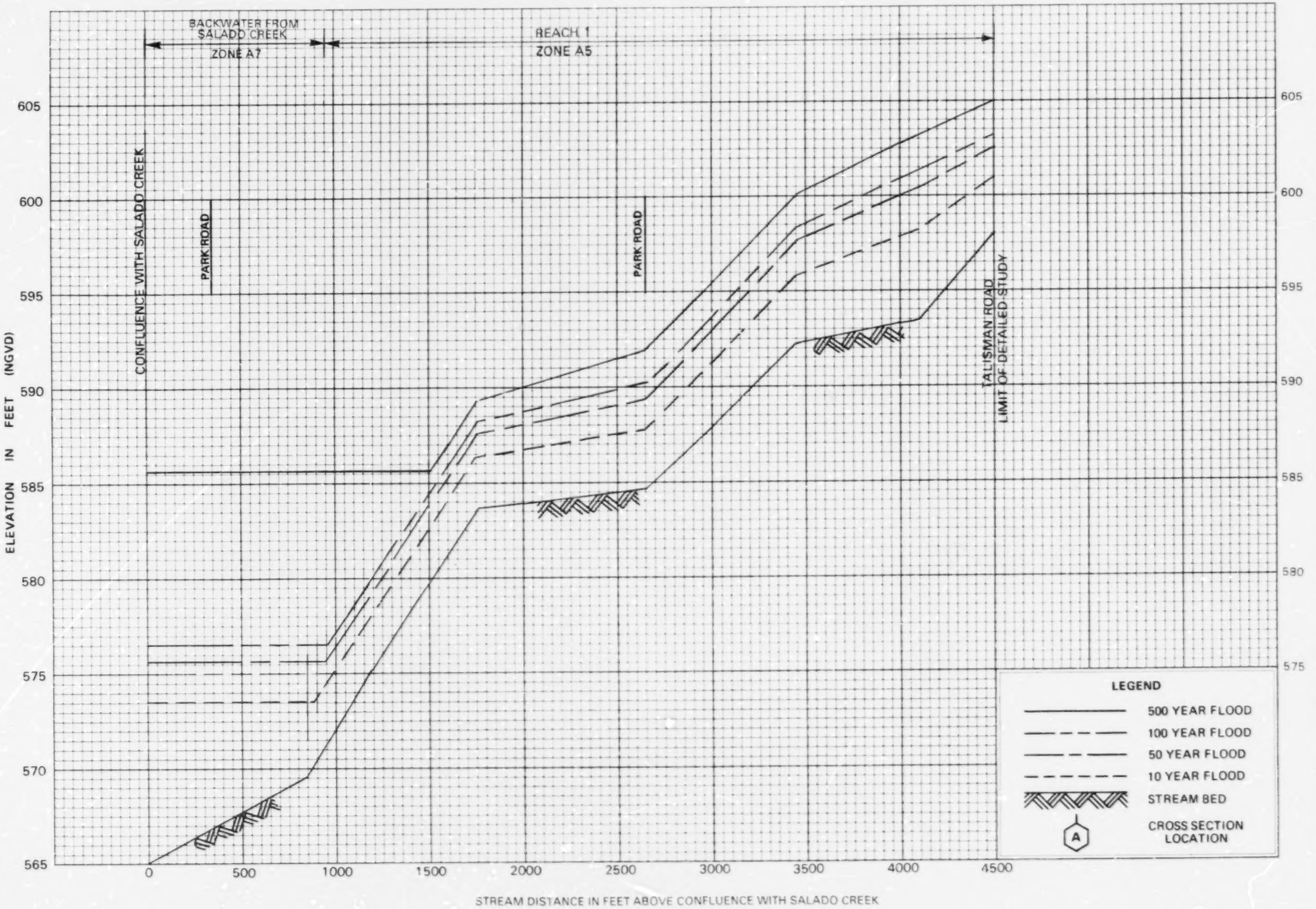
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

SALADO CREEK

BEST COPY AVAILABLE



FLOOD PROFILES

TRIBUTARY A TO SALADO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

55P

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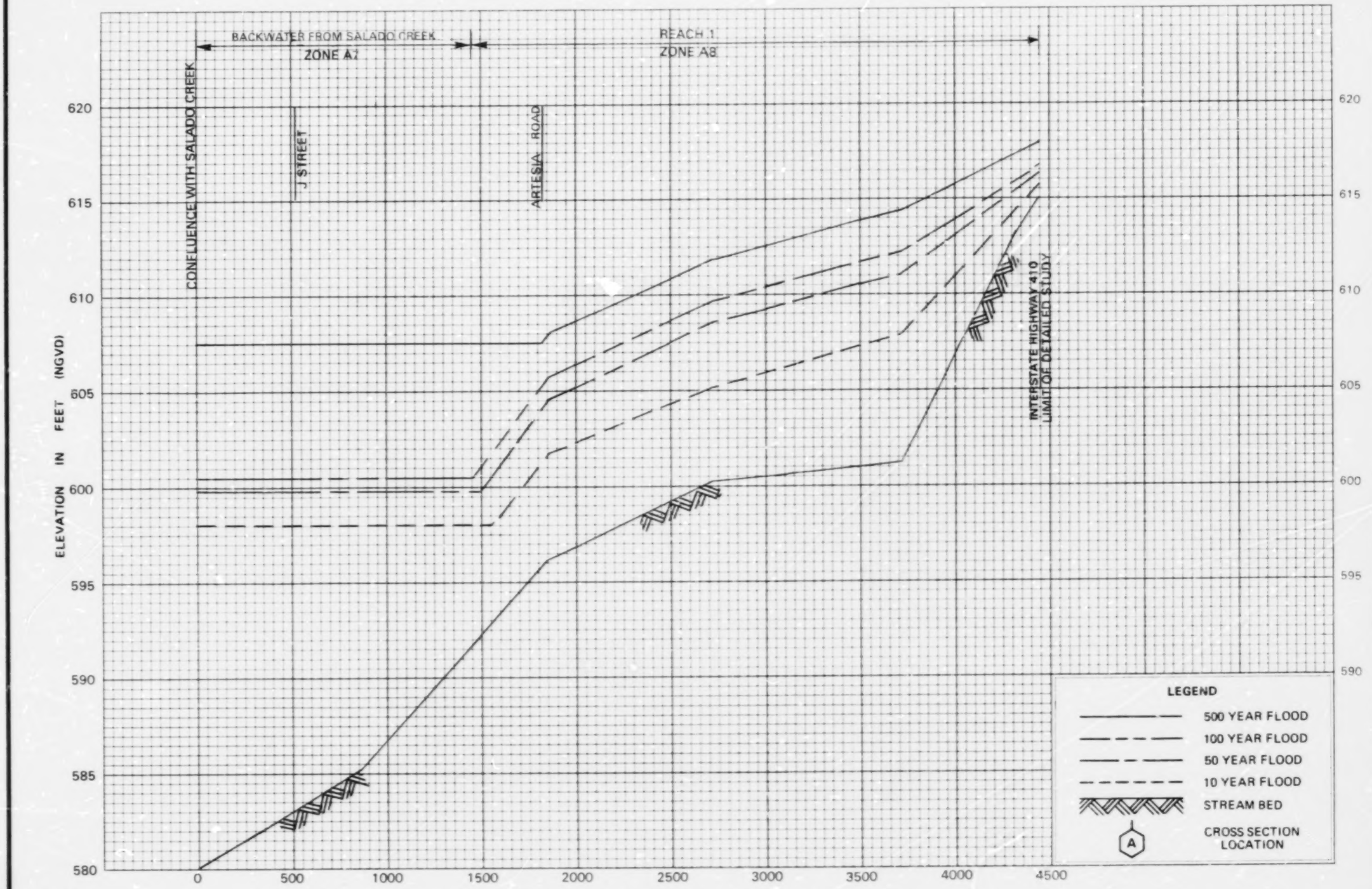

FLOOD PROFILES

TRIBUTARY B TO SALADO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

56P

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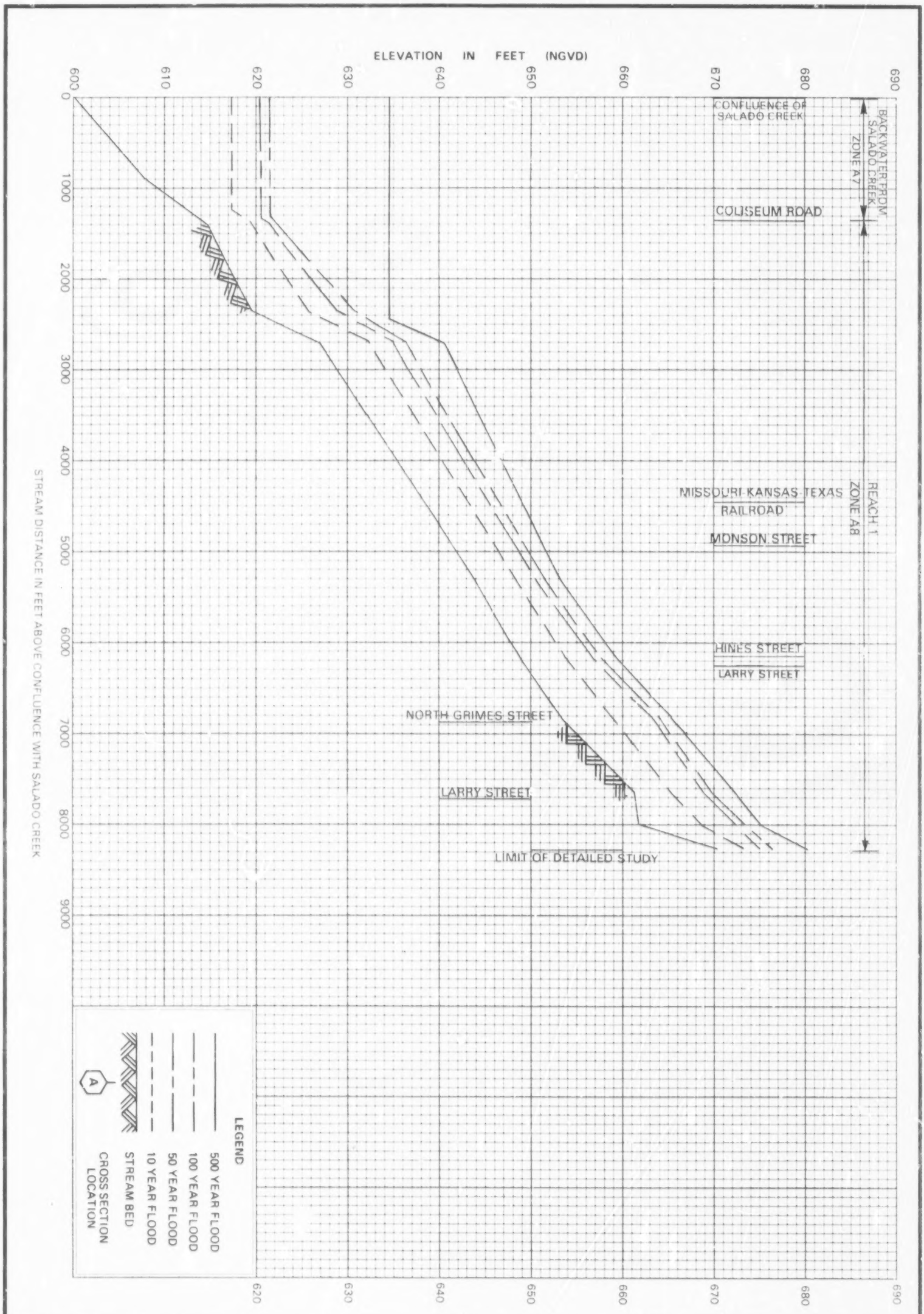


FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

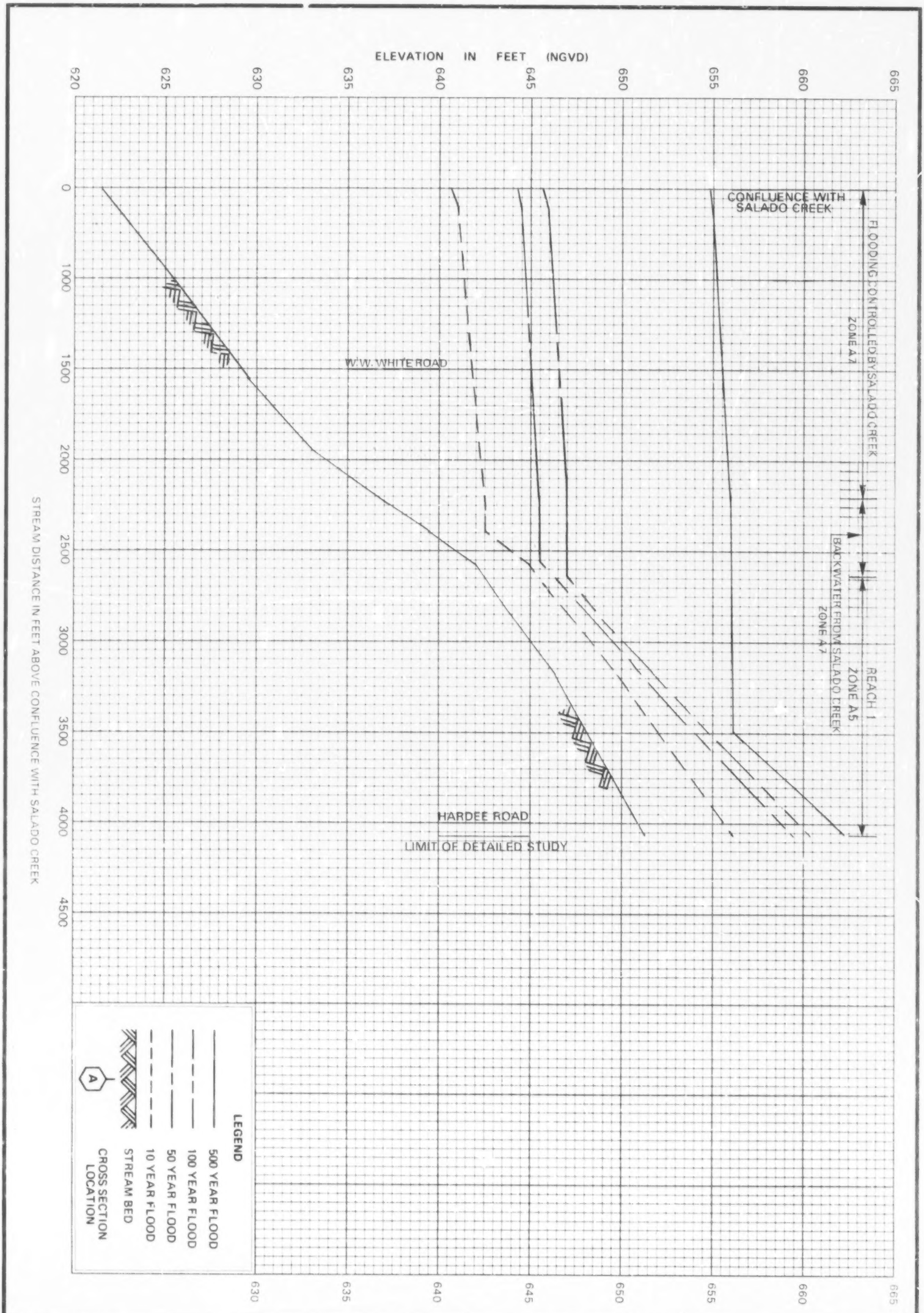
(BEXAR CO.)

57P

FLOOD PROFILES

TRIBUTARY C TO SALADO CREEK

BEST COPY AVAILABLE



58P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

FORT SAM HOUSTON TRIBUTARY TO SALADO CREEK

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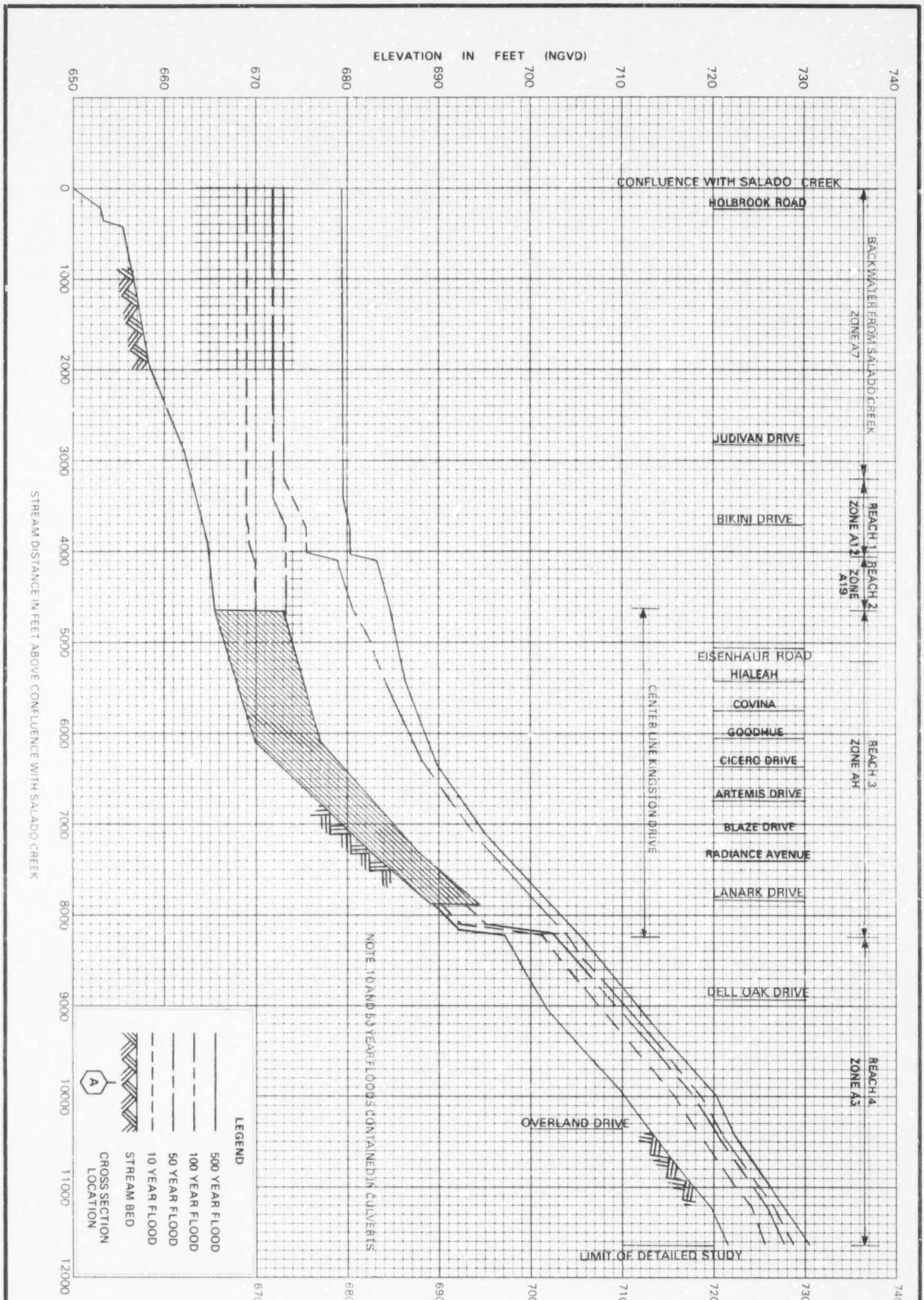

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

WALZEM CREEK

59P

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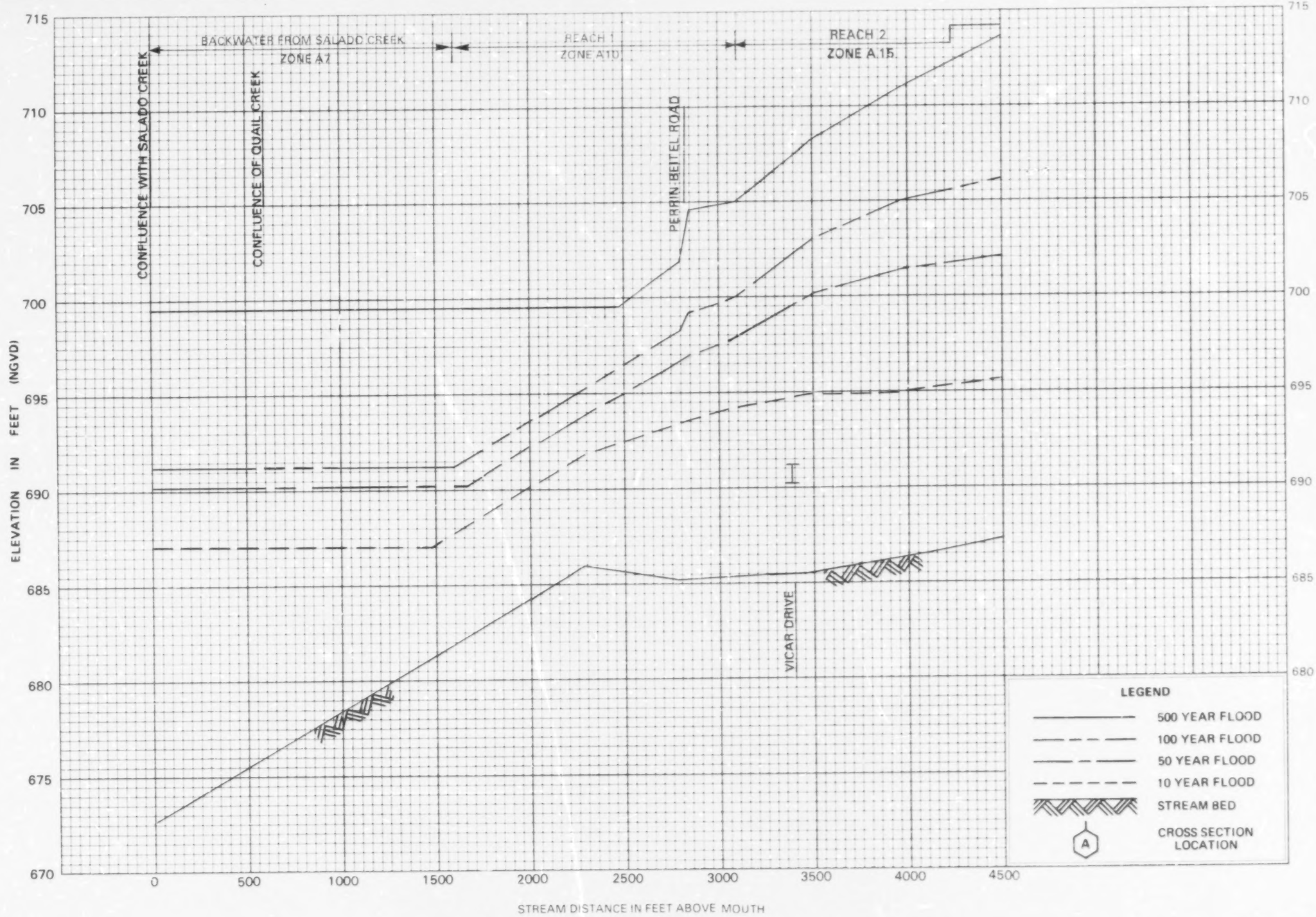

FLOOD PROFILES

BEITEL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

60P

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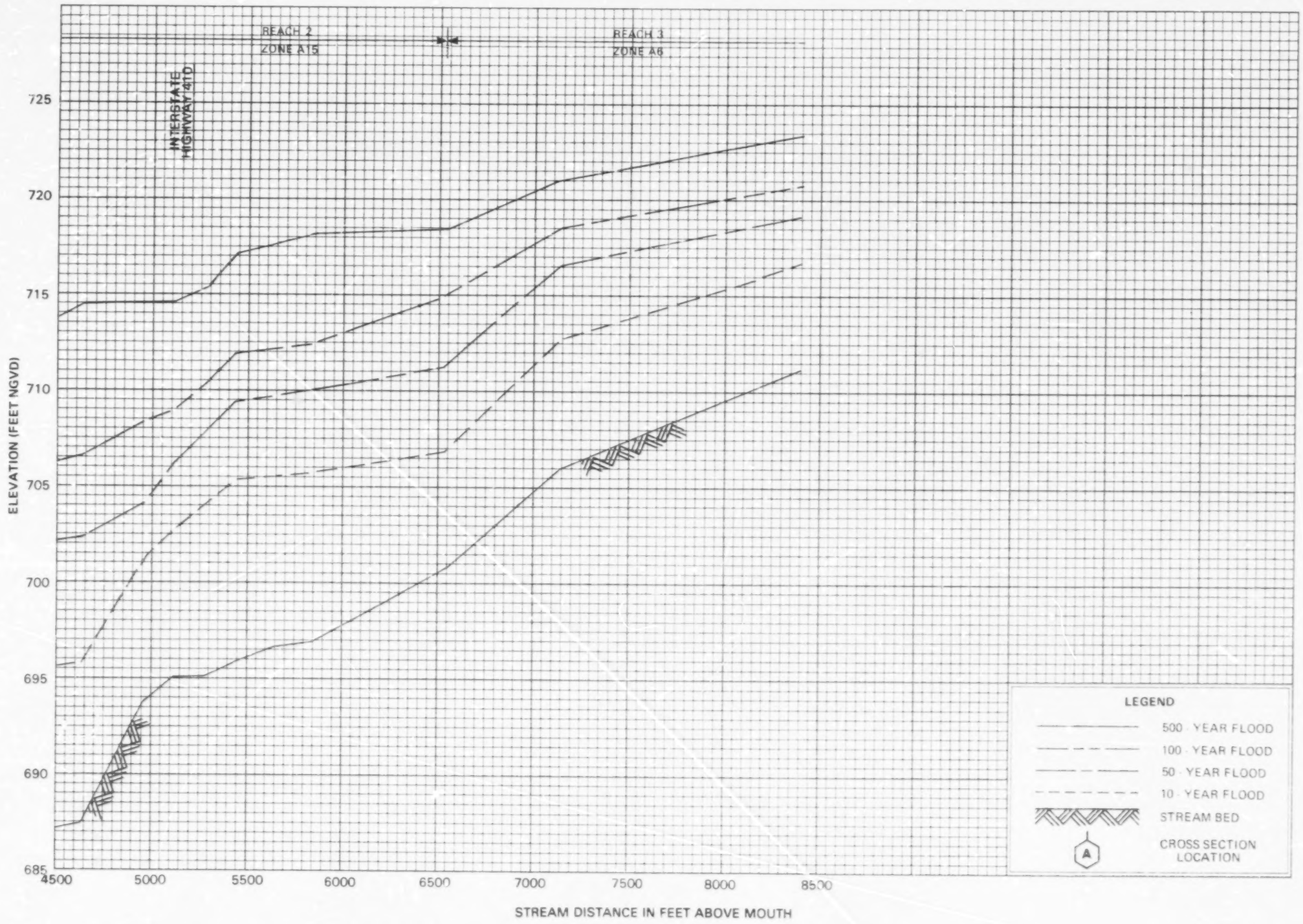


FLOOD PROFILES

BEITEL CREEK

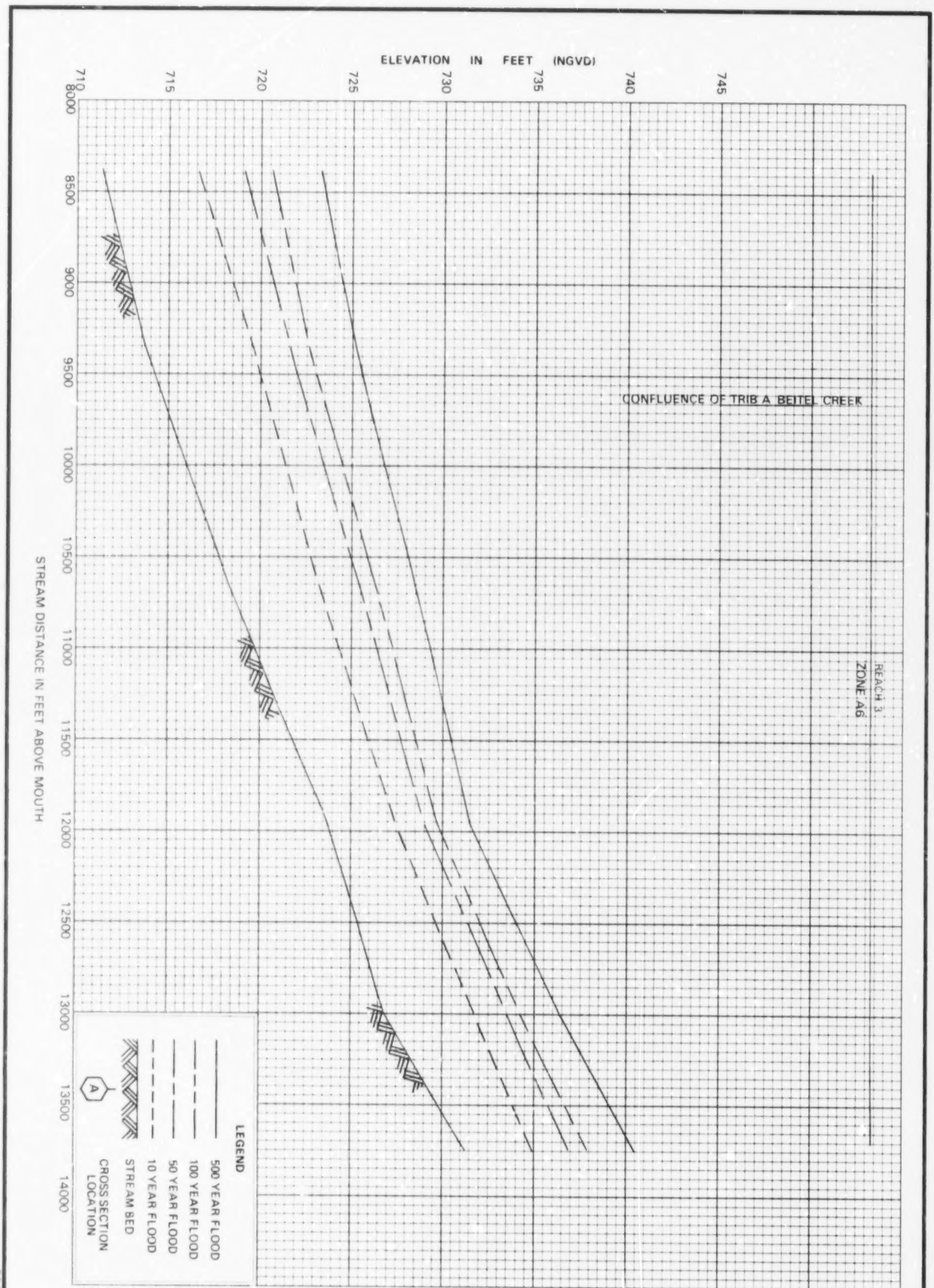
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

61P

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

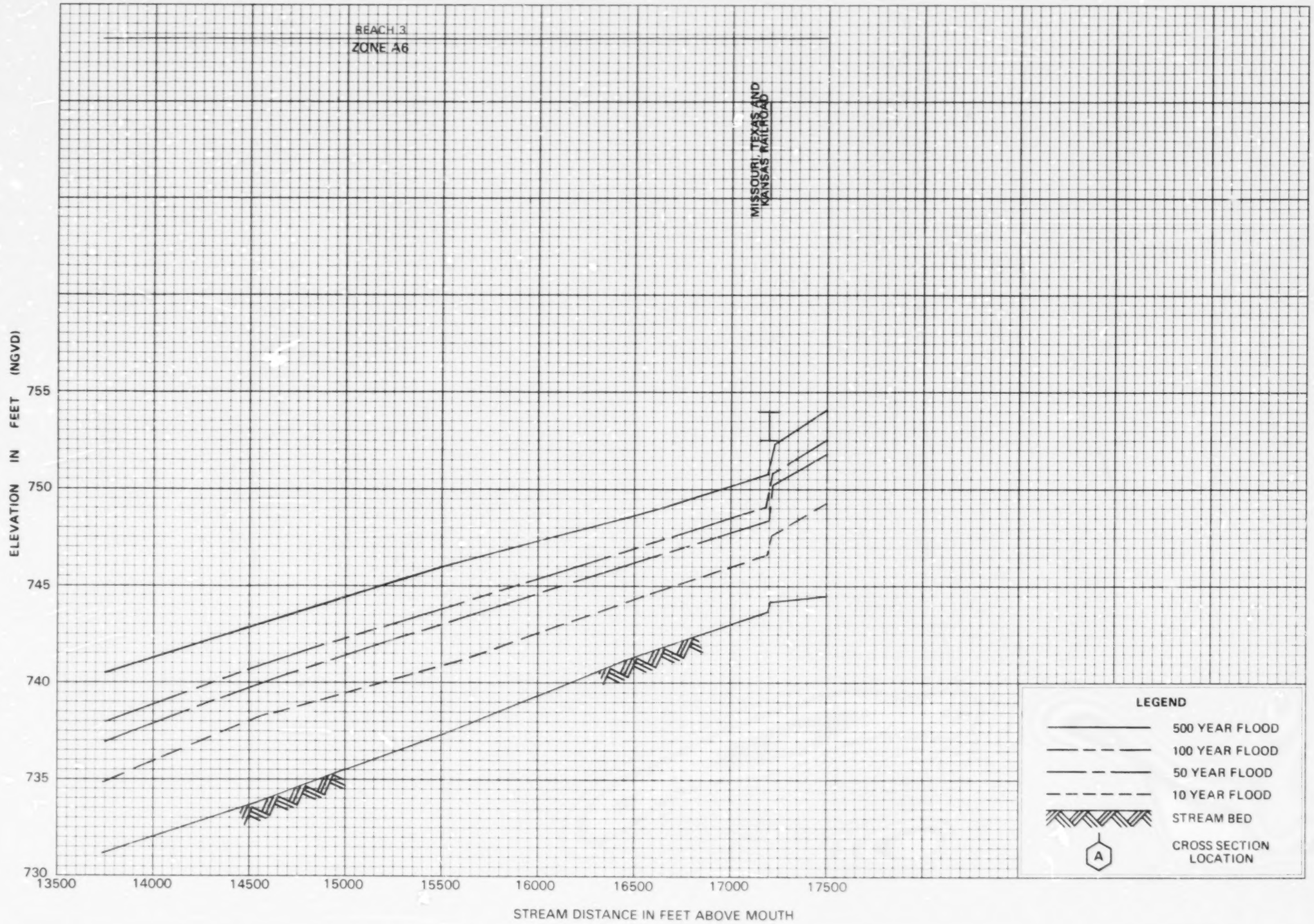
62P

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

BEITEL CREEK



FLOOD PROFILES

BEITEL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

63P

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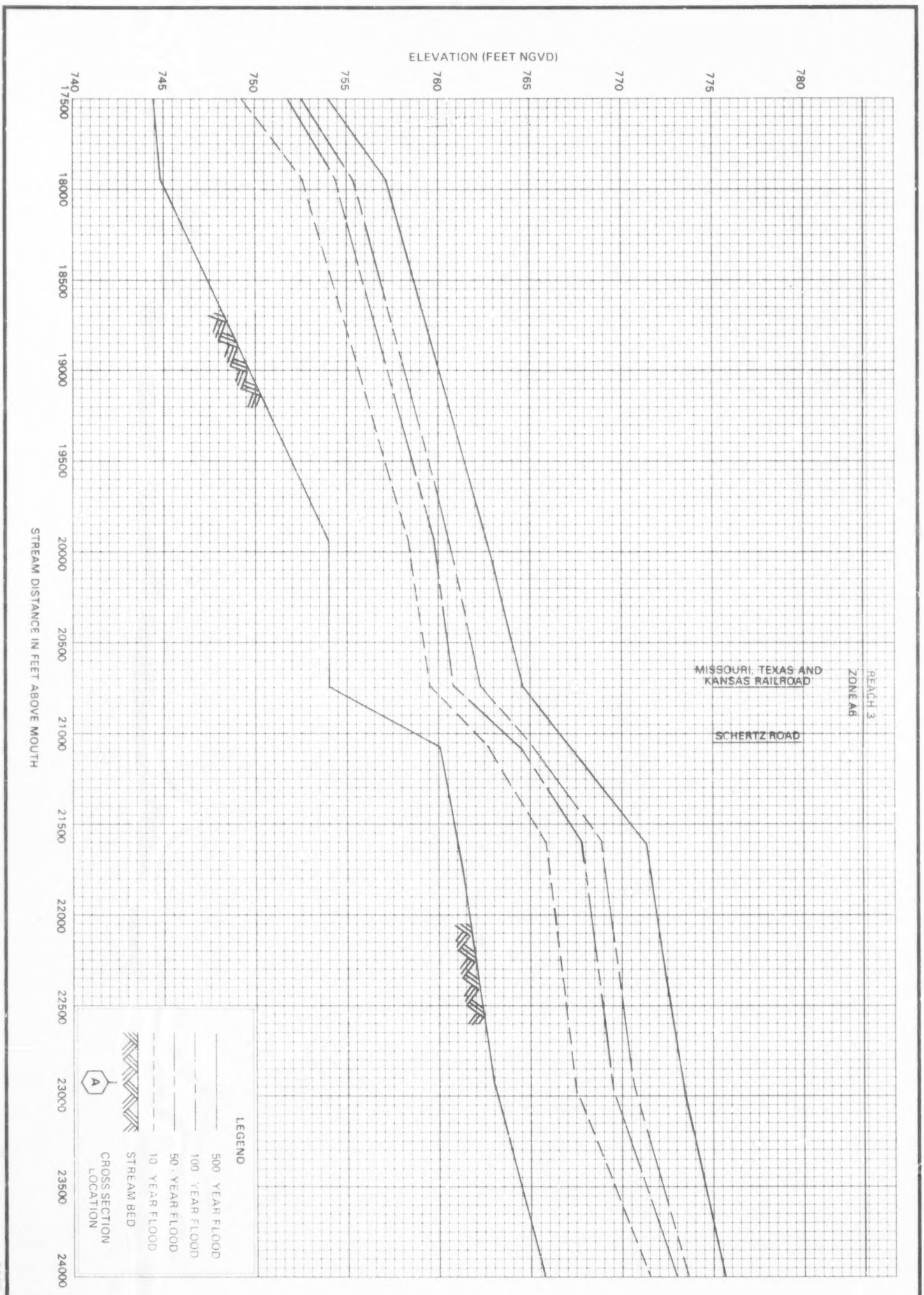


64P

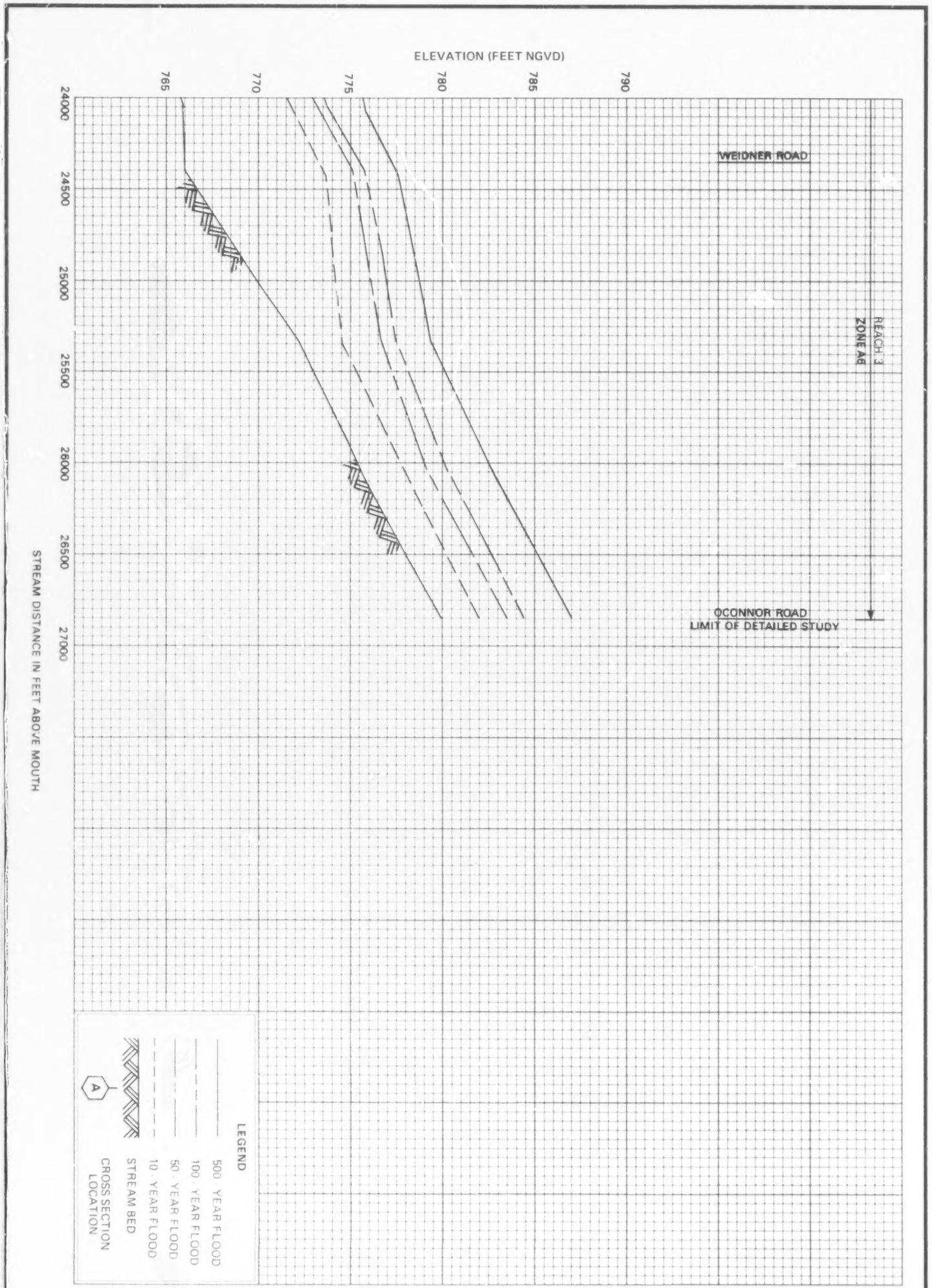
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

BEITEL CREEK



65P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

BEITEL CREEK

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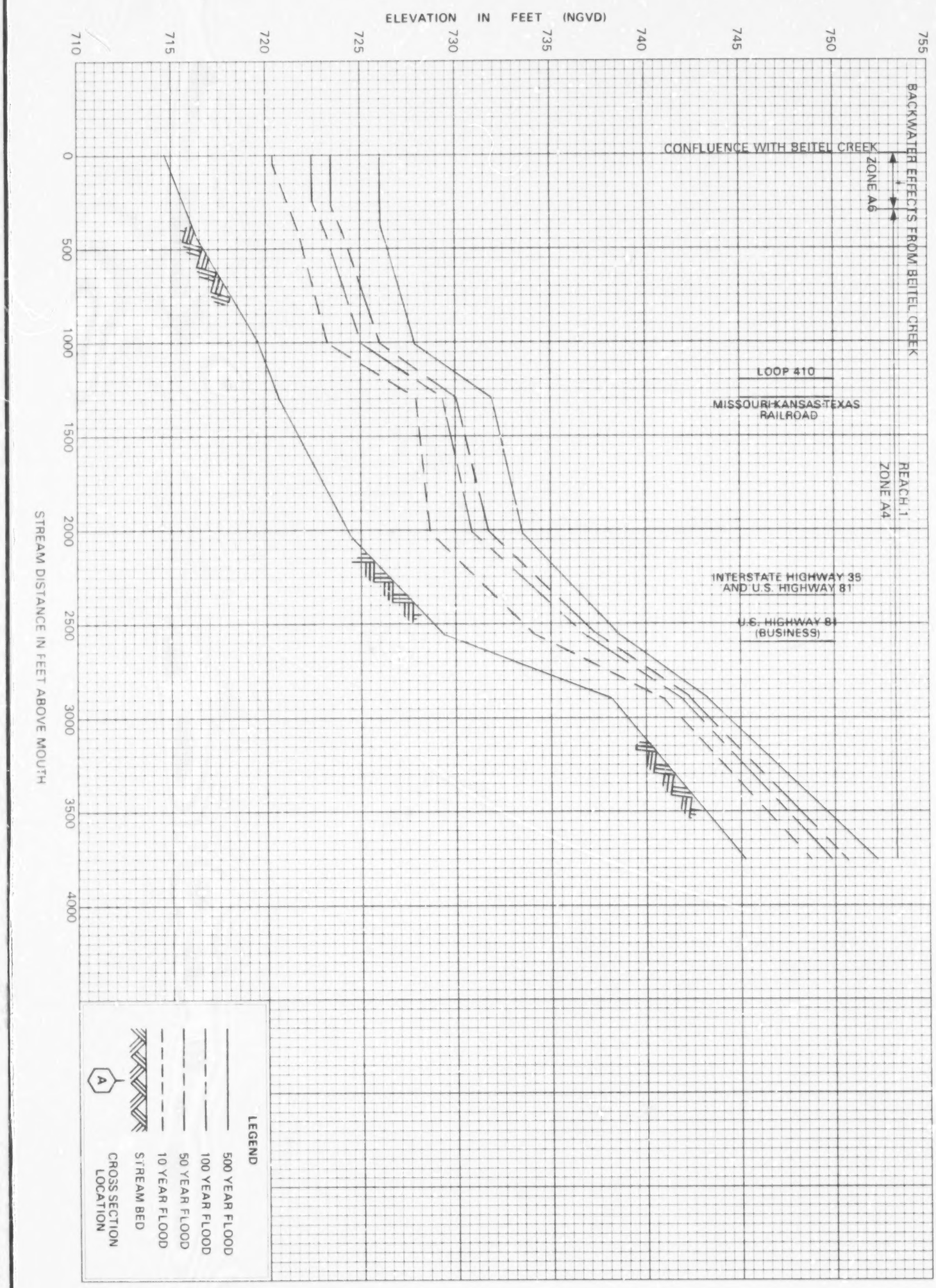

66P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES BEITEL CREEK-TRIB A

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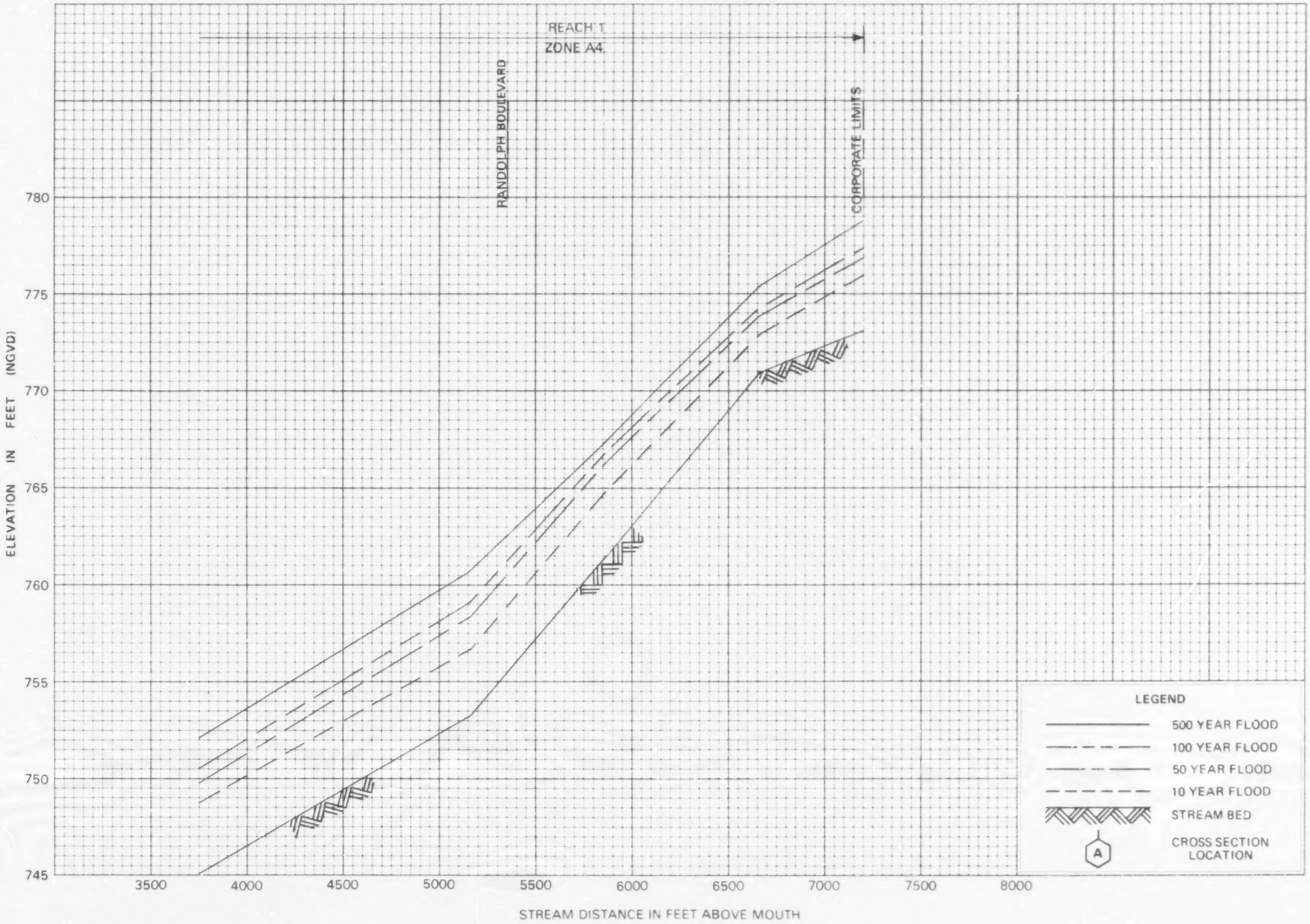

FLOOD PROFILES

BEITEL CREEK-TRIB A

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

67P

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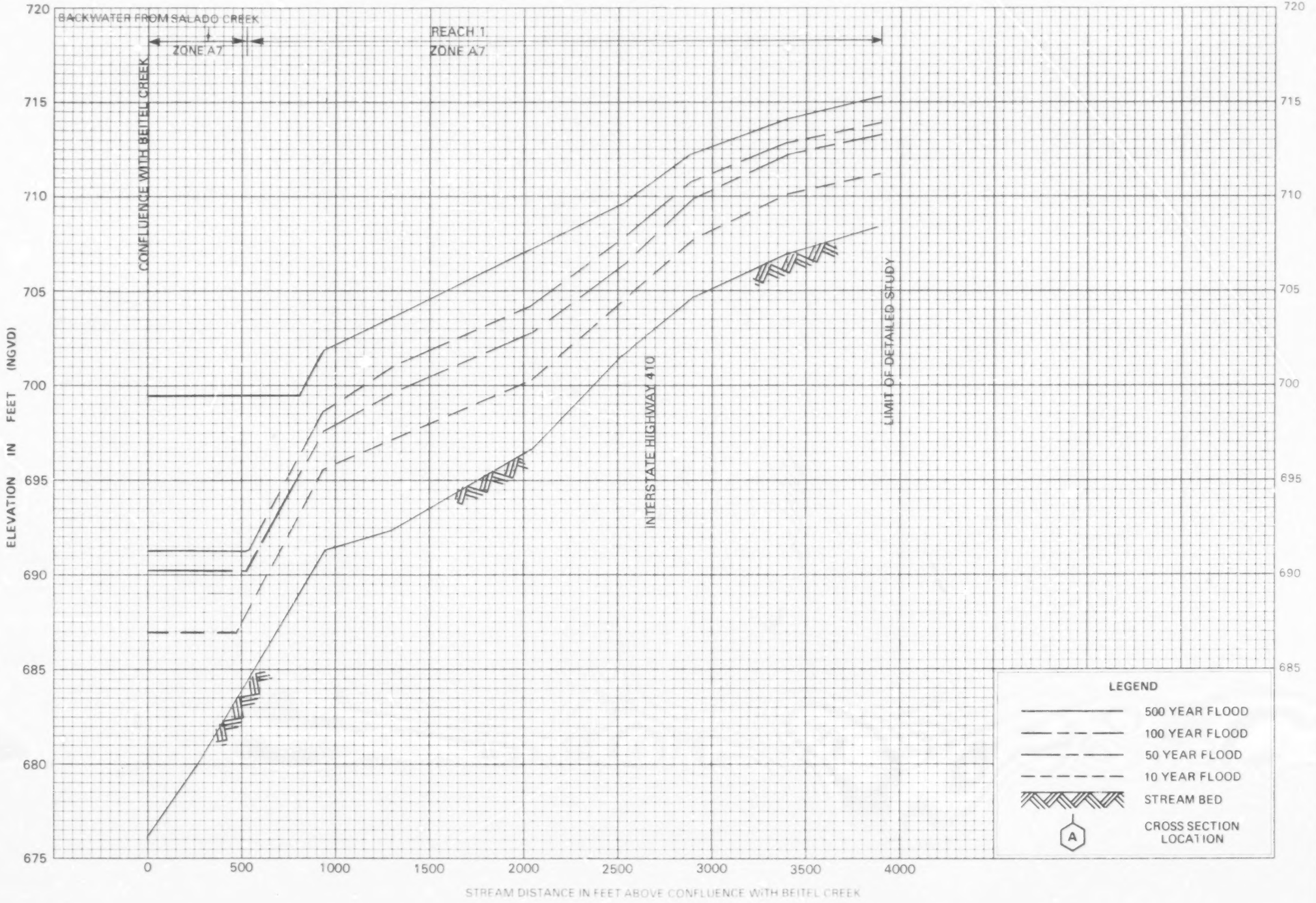

FLOOD PROFILES

QUAIL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

68P

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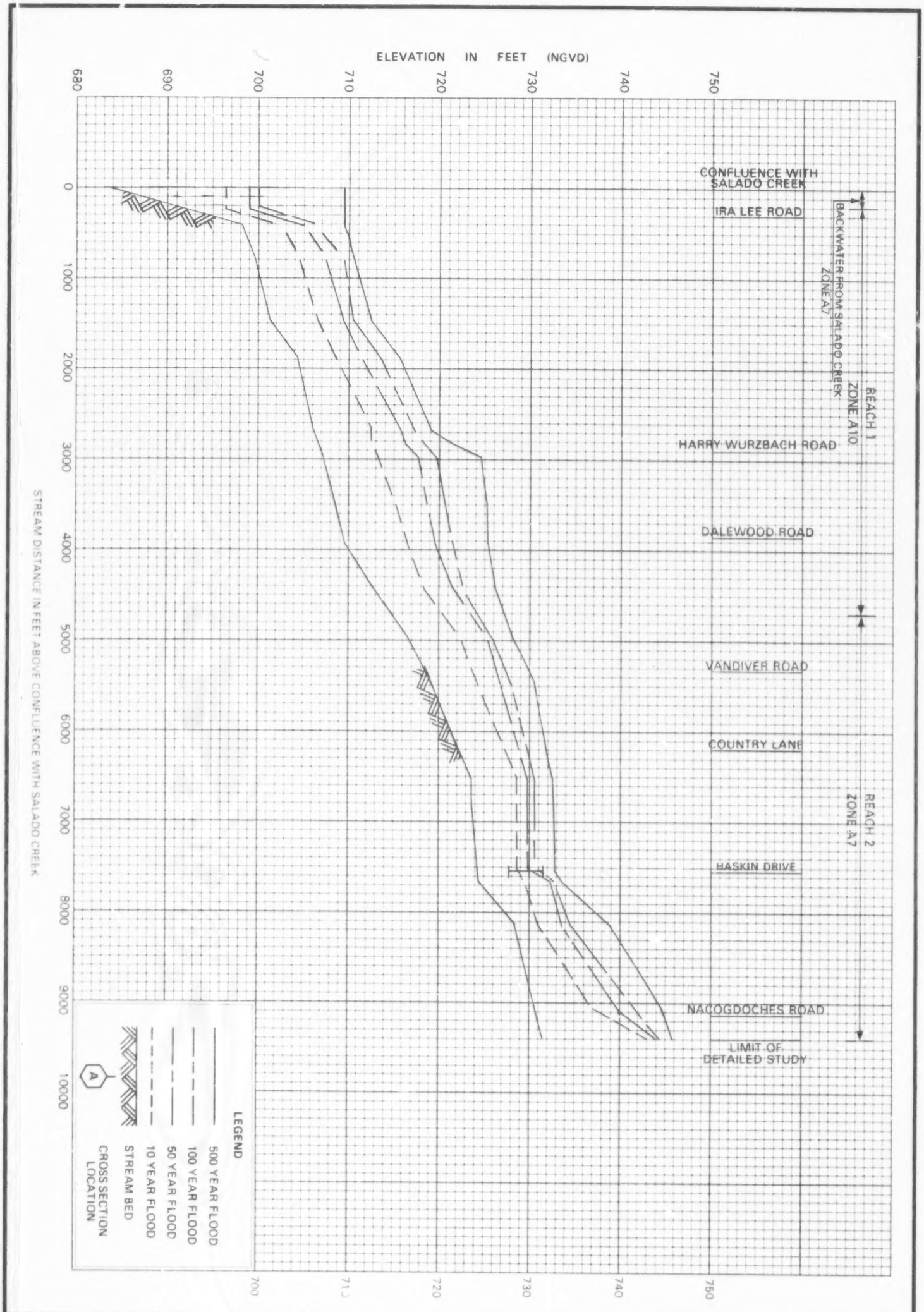

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

TRIBUTARY D TO SALADO CREEK

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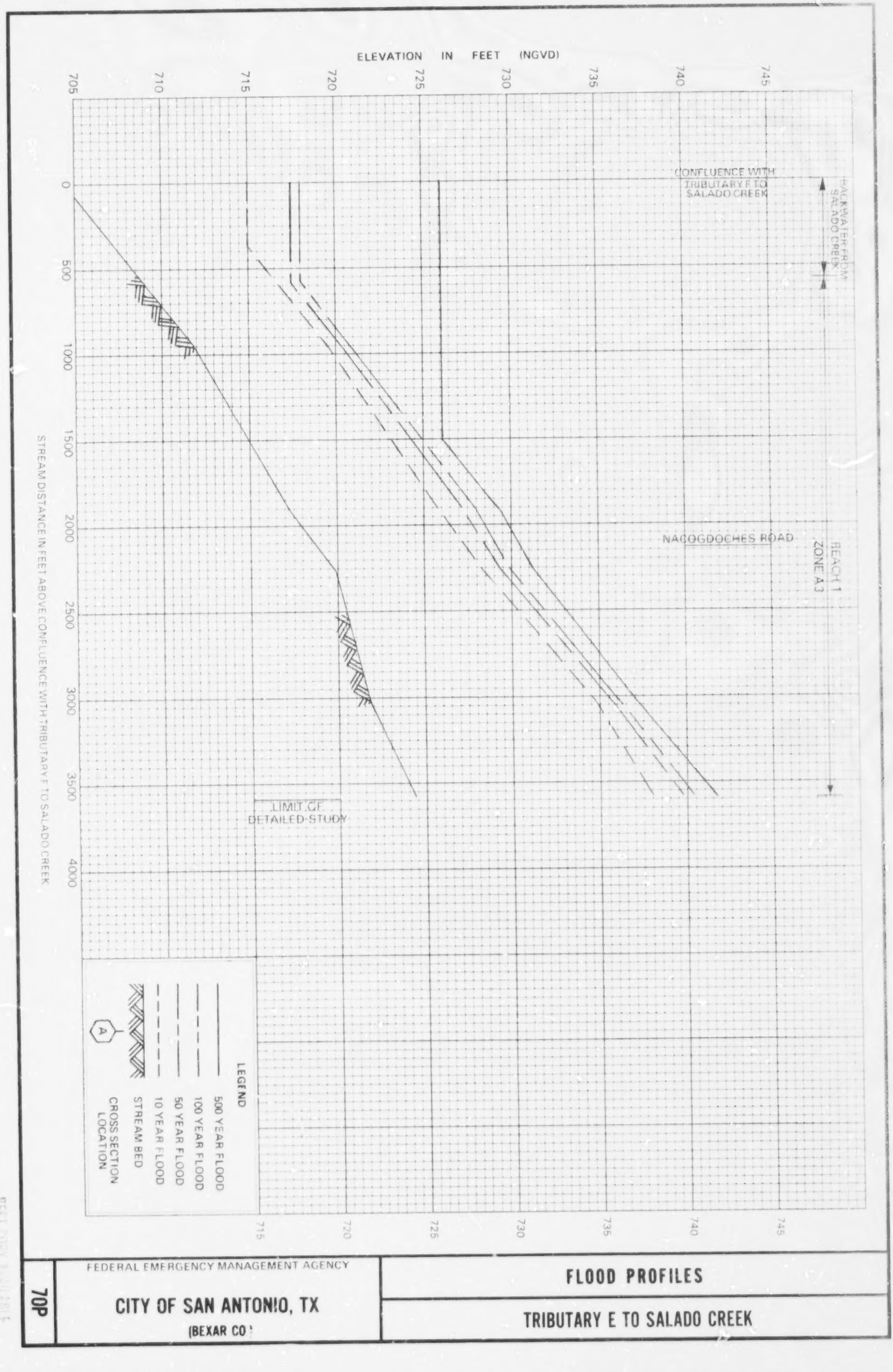
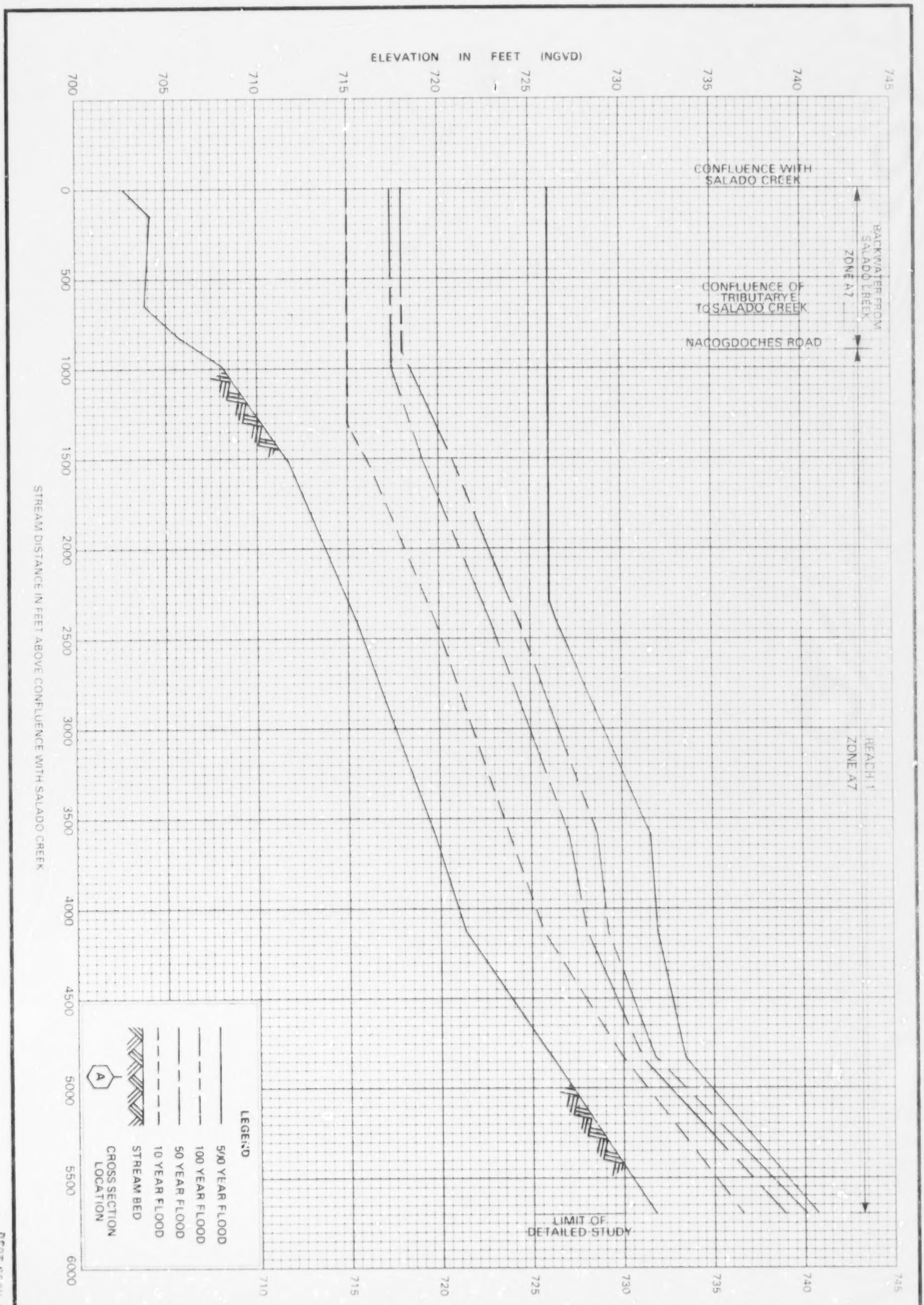


70P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO	FLOOD PROFILES TRIBUTARY E TO SALADO CREEK



71P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES TRIBUTARY F TO SALADO CREEK

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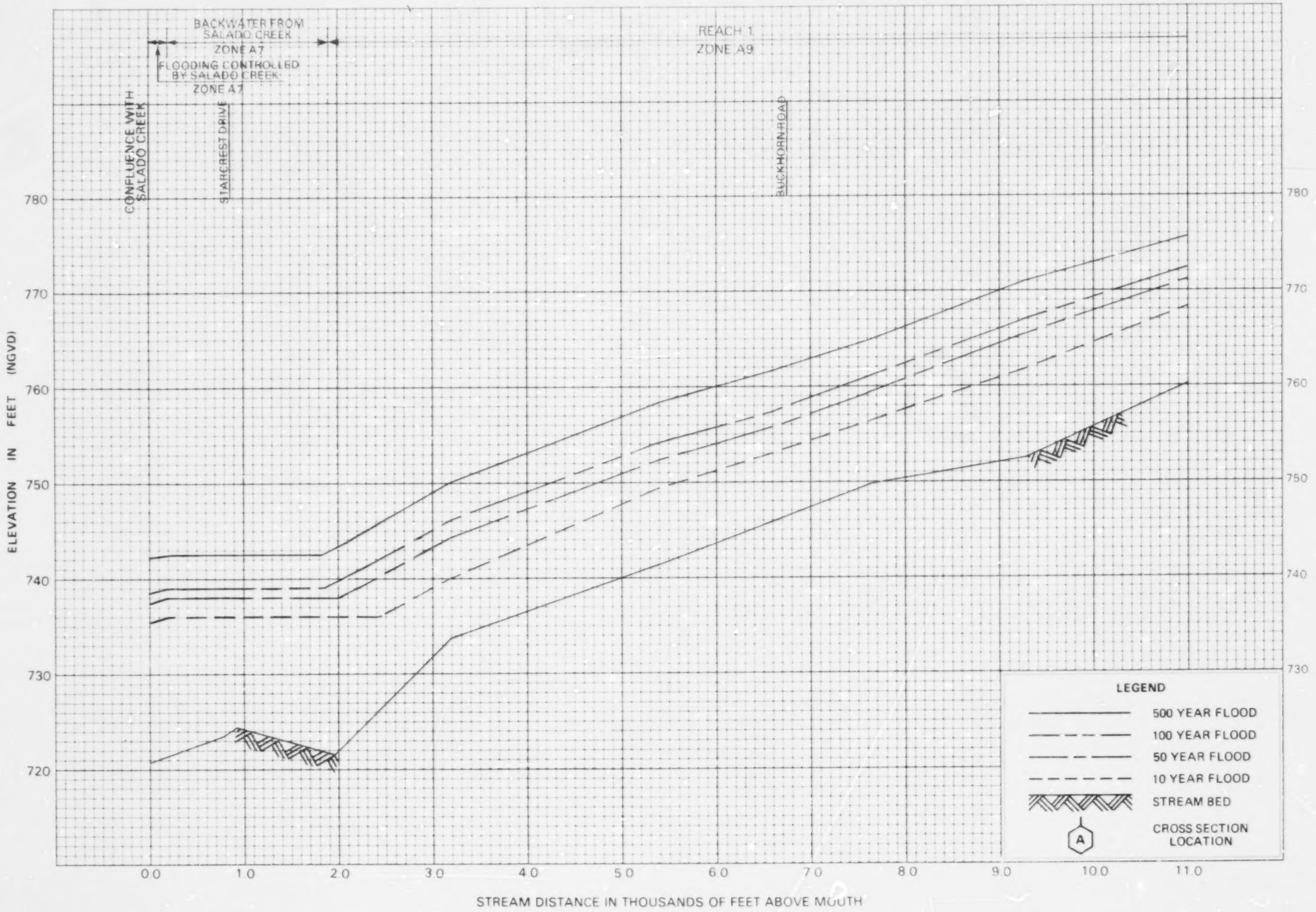

FLOOD PROFILES

MUD CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

72P

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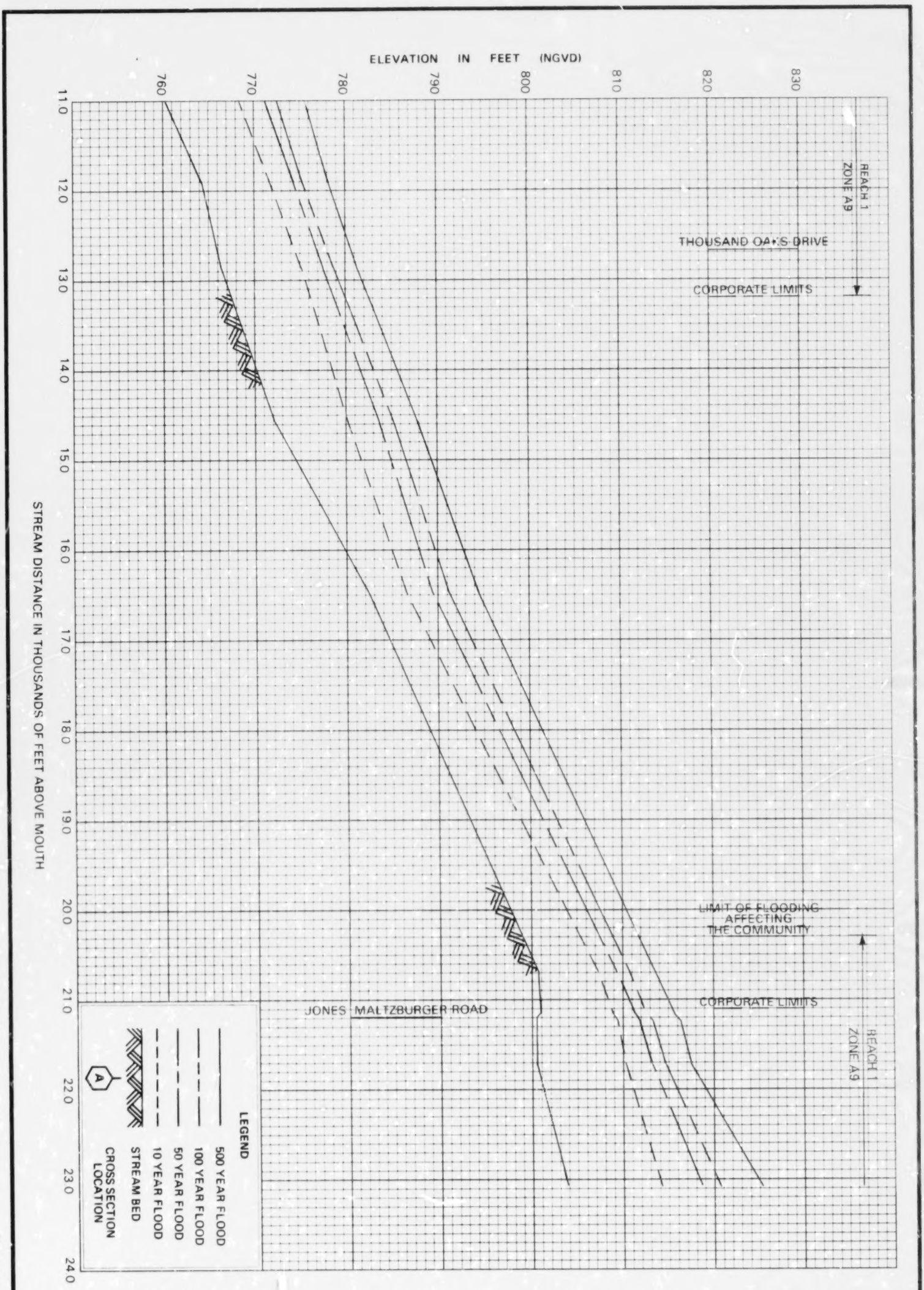

73P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES MUD CREEK

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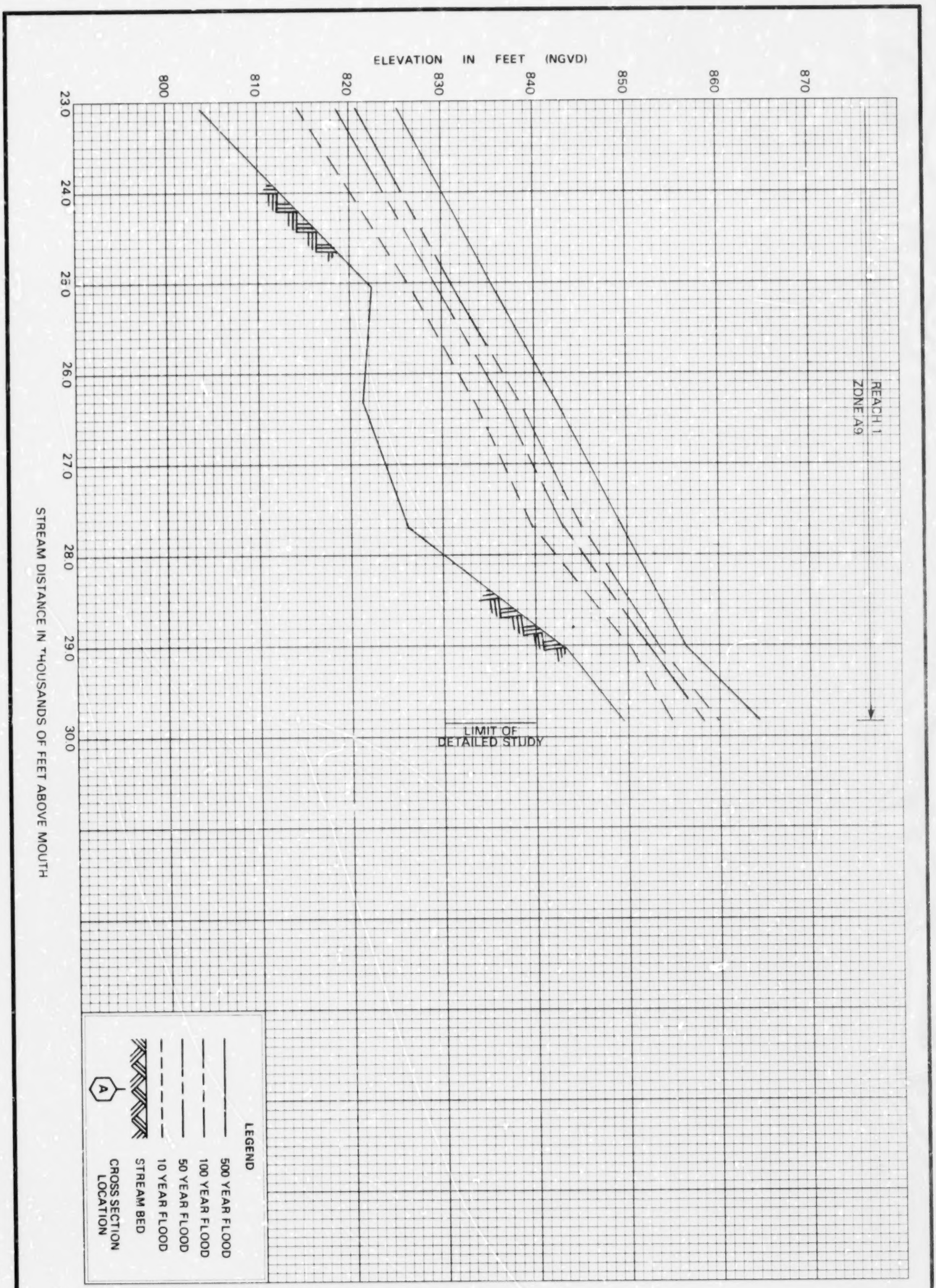
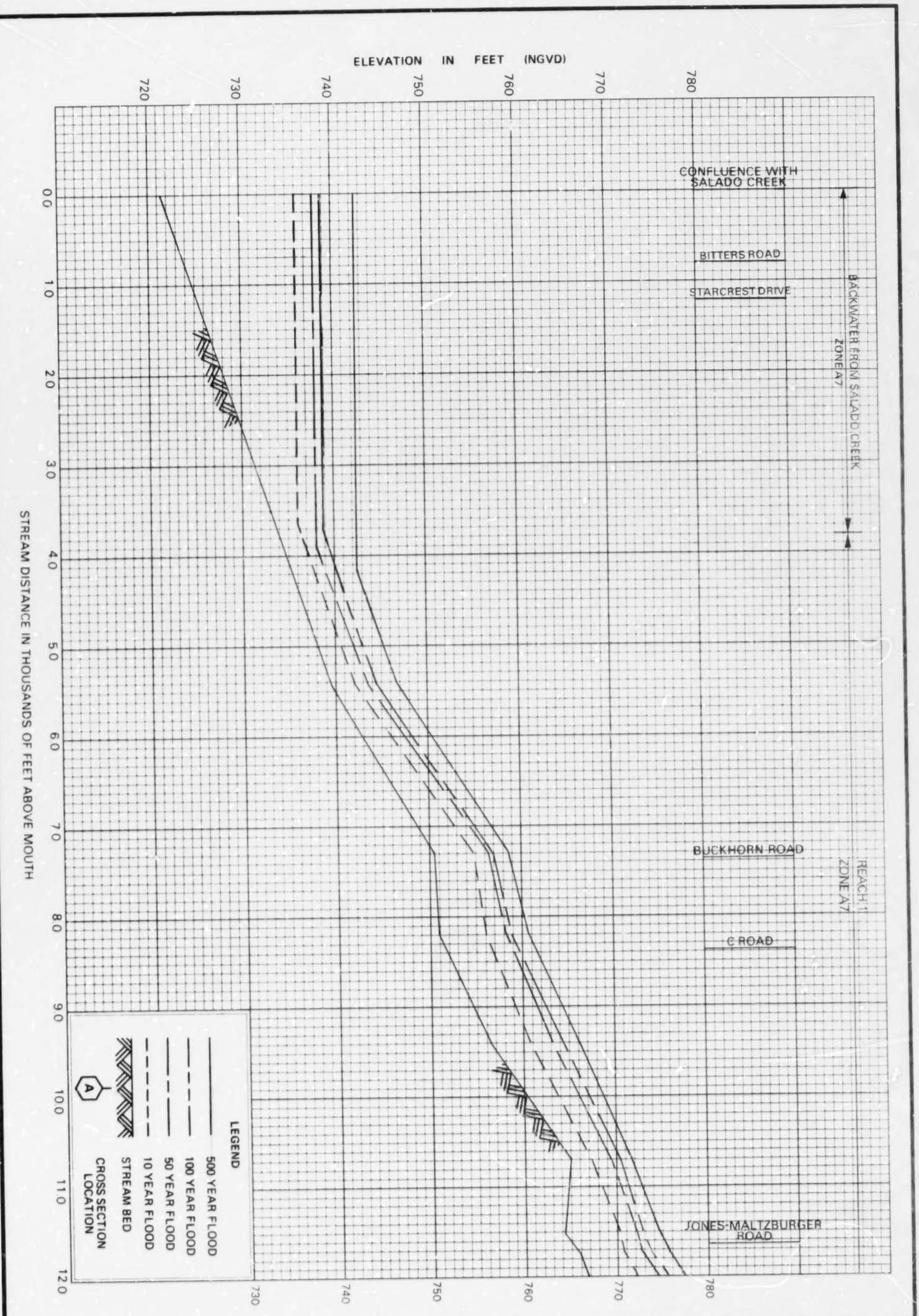


74P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES MUD CREEK

BEST COPY AVAILABLE



75P

FEDERAL EMERGENCY MANAGEMENT AGENCY

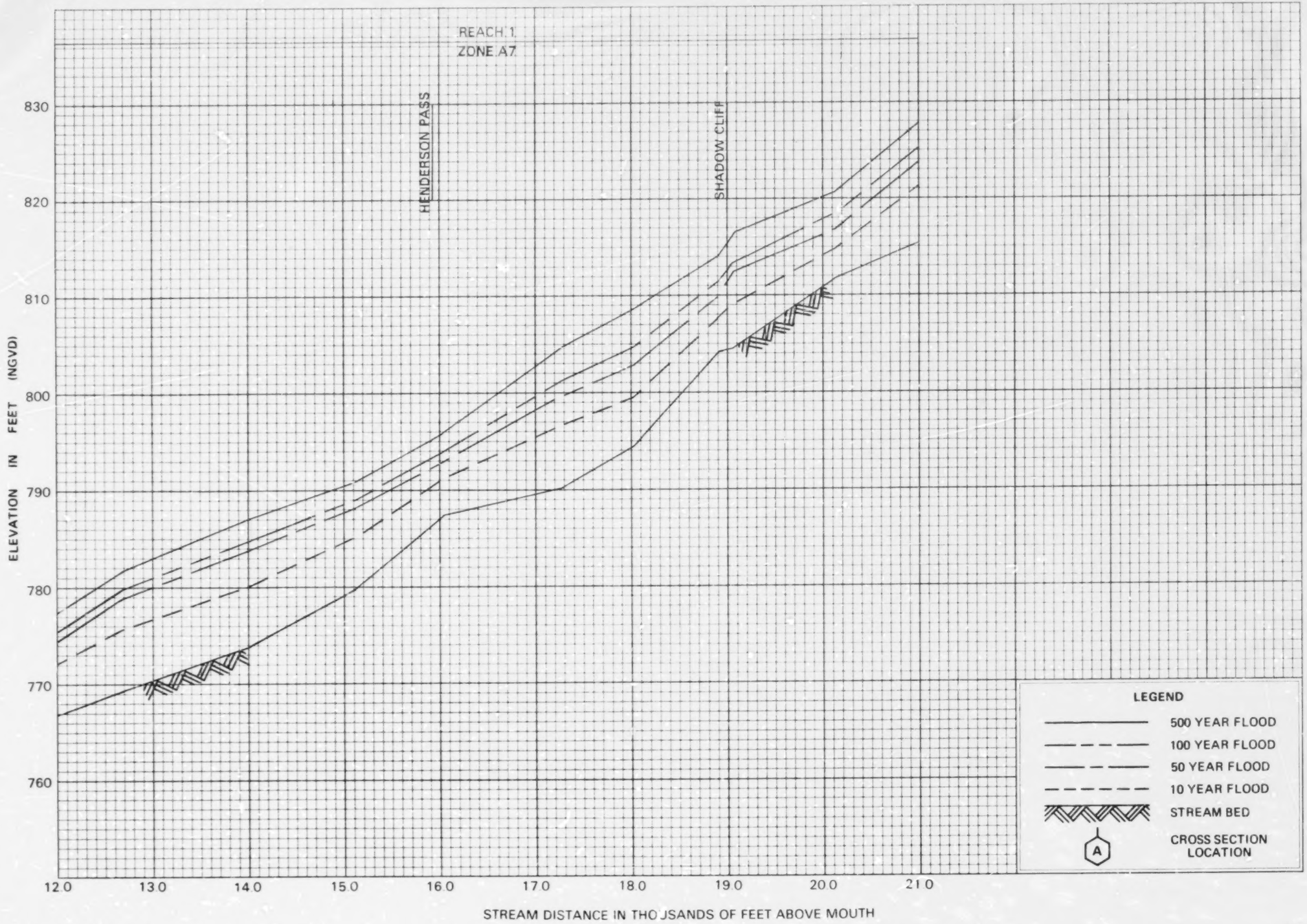
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

LORENCE CREEK

BEST COPY AVAILABLE



FLOOD PROFILES

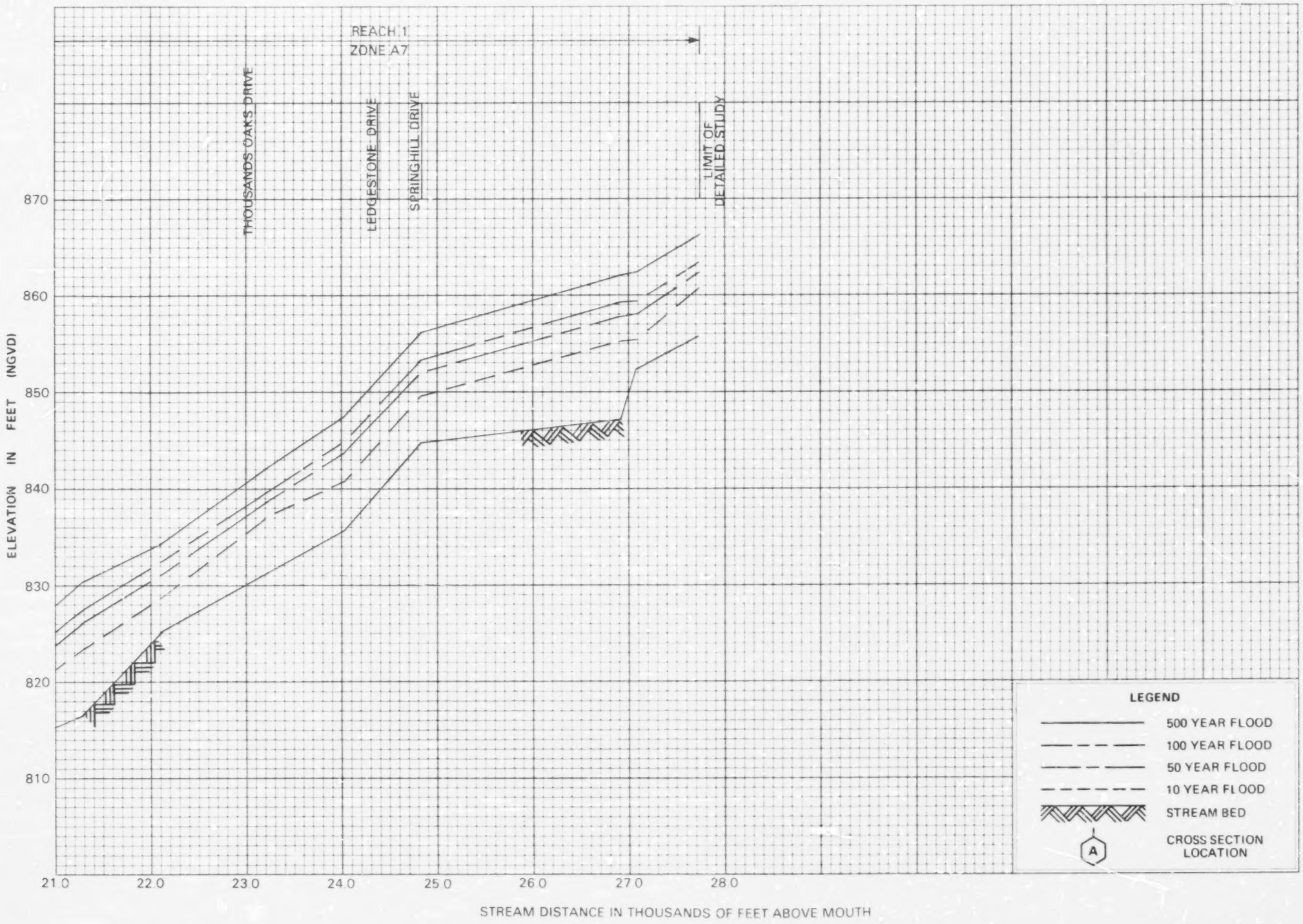
LORENCE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

76P

BEST COPY AVAILABLE



FLOOD PROFILES

LORENCE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

77P

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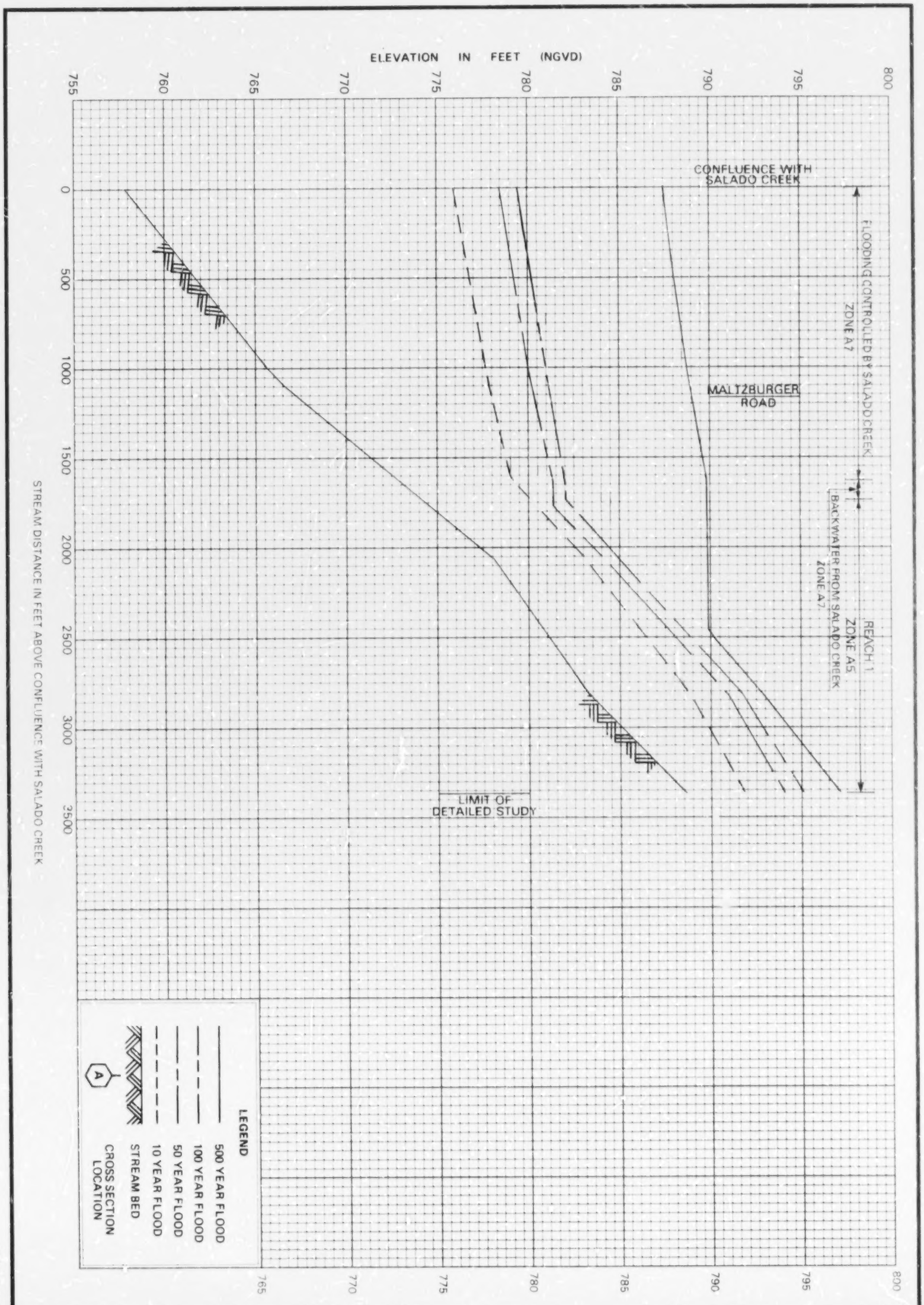
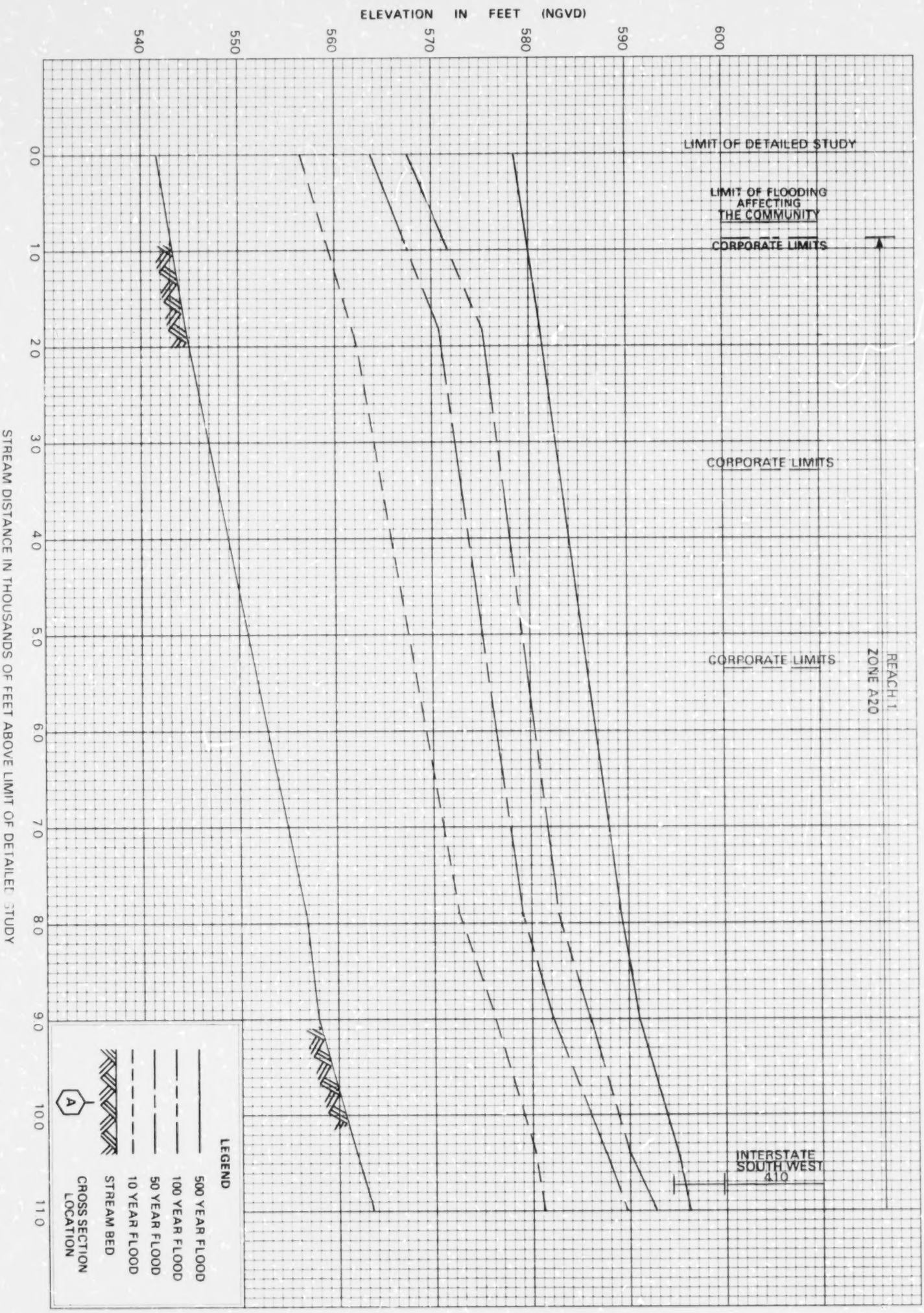


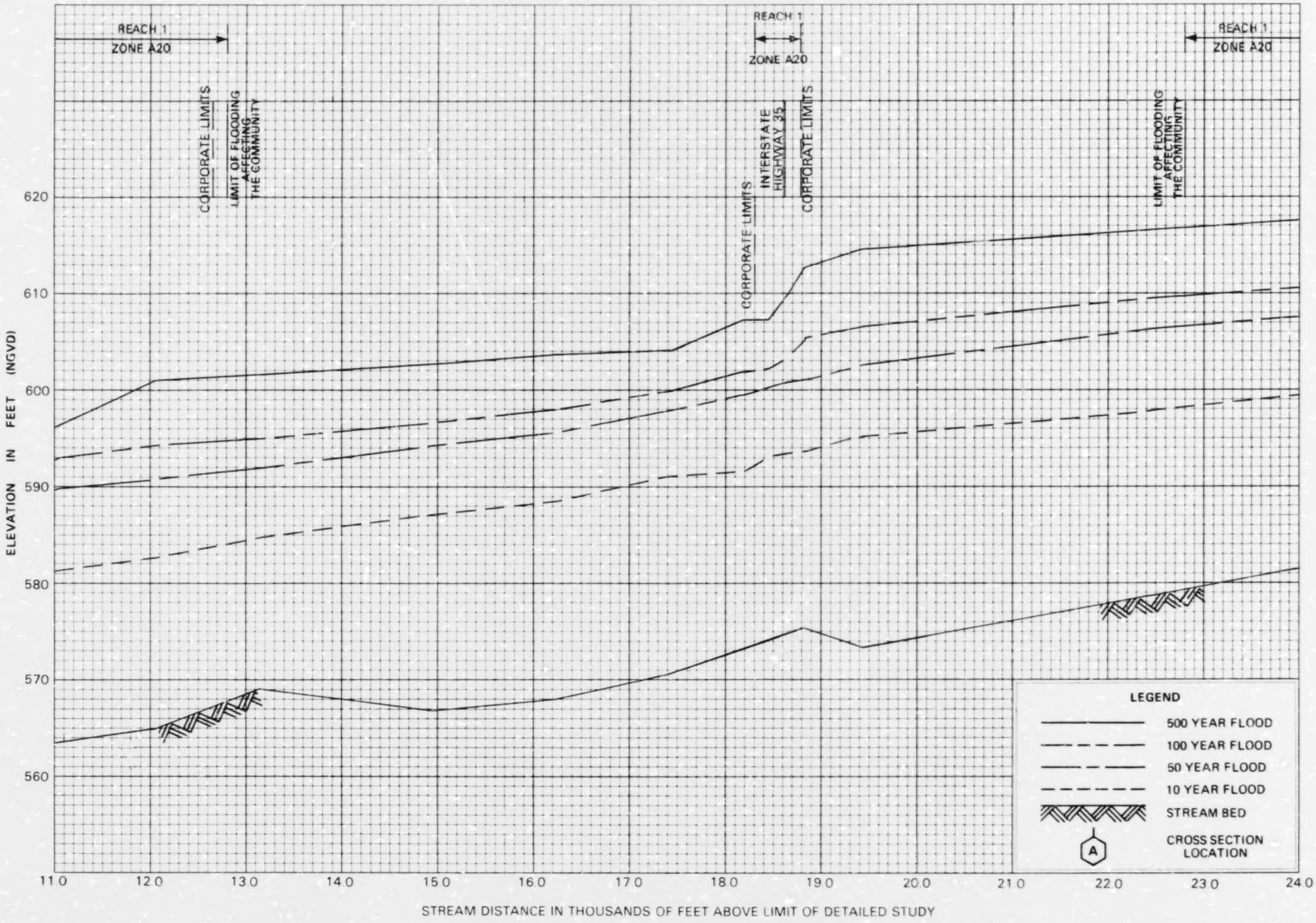
78P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES U.S. 281 TRIBUTARY TO SALADO CREEK

BEST COPY AVAILABLE



79P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES LEON CREEK

BEST COPY AVAILABLE



FLOOD PROFILES

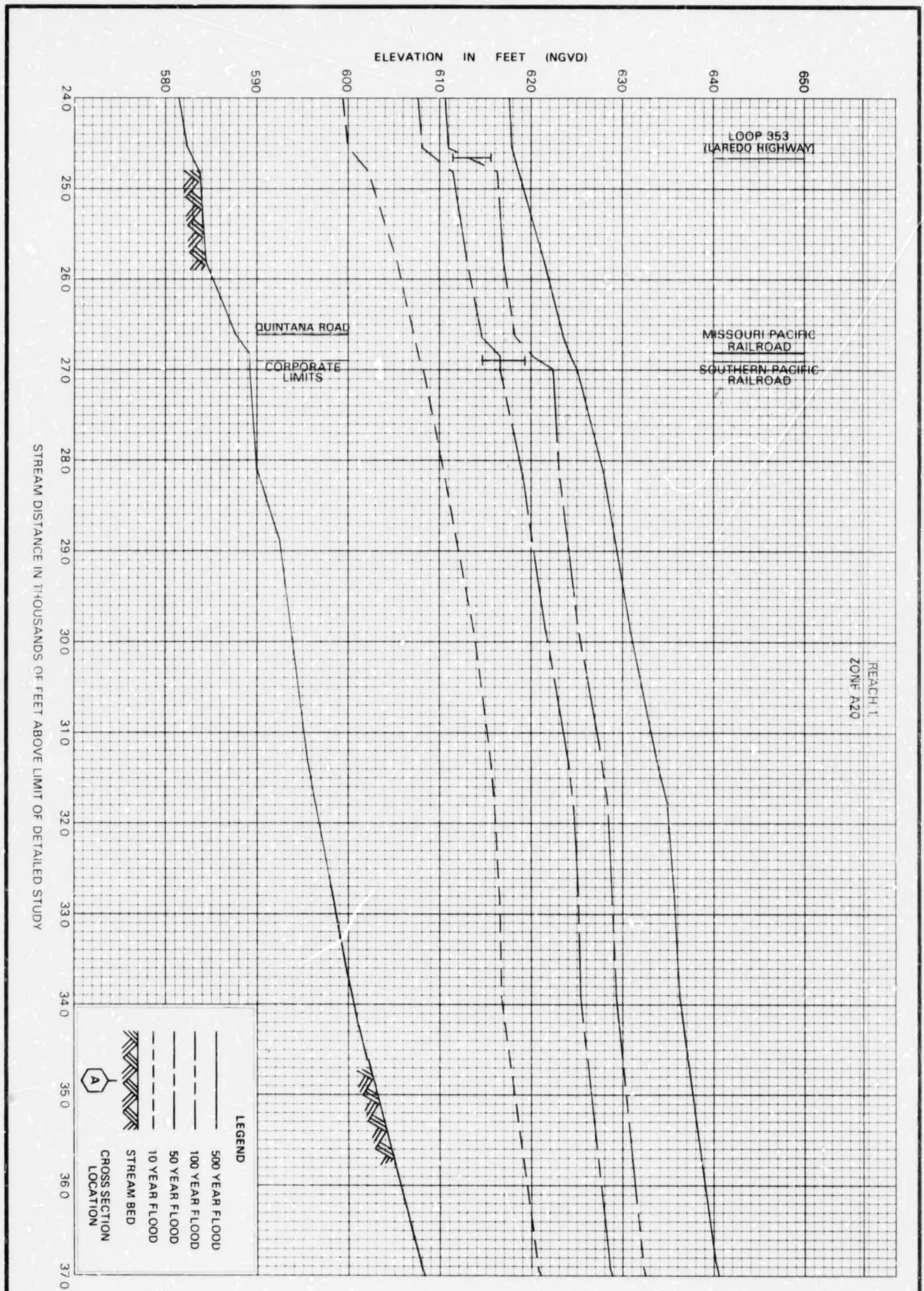
LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

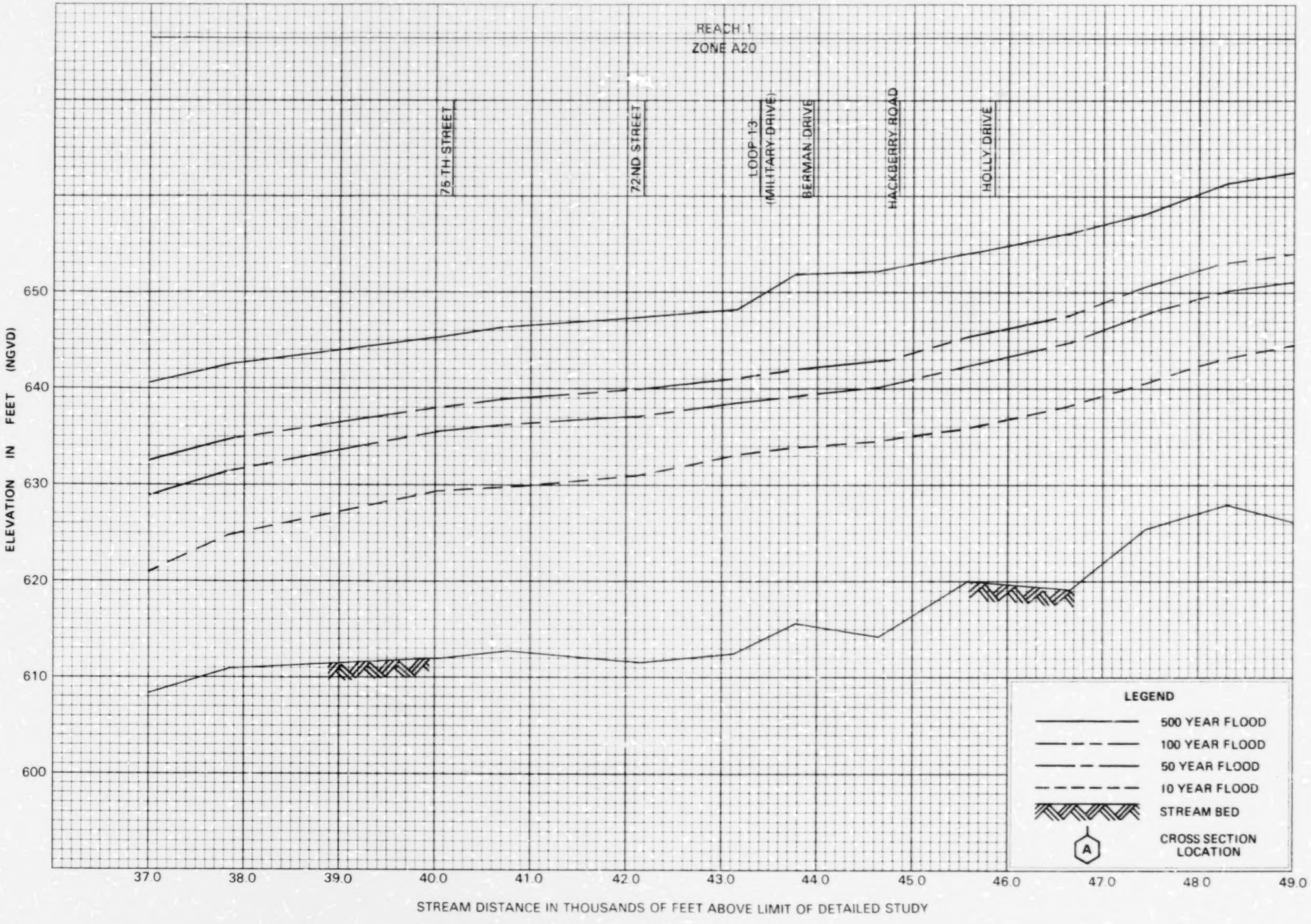
80P

BEST COPY AVAILABLE



81P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES LEON CREEK

BEST COPY AVAILABLE



FLOOD PROFILES

LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

82P

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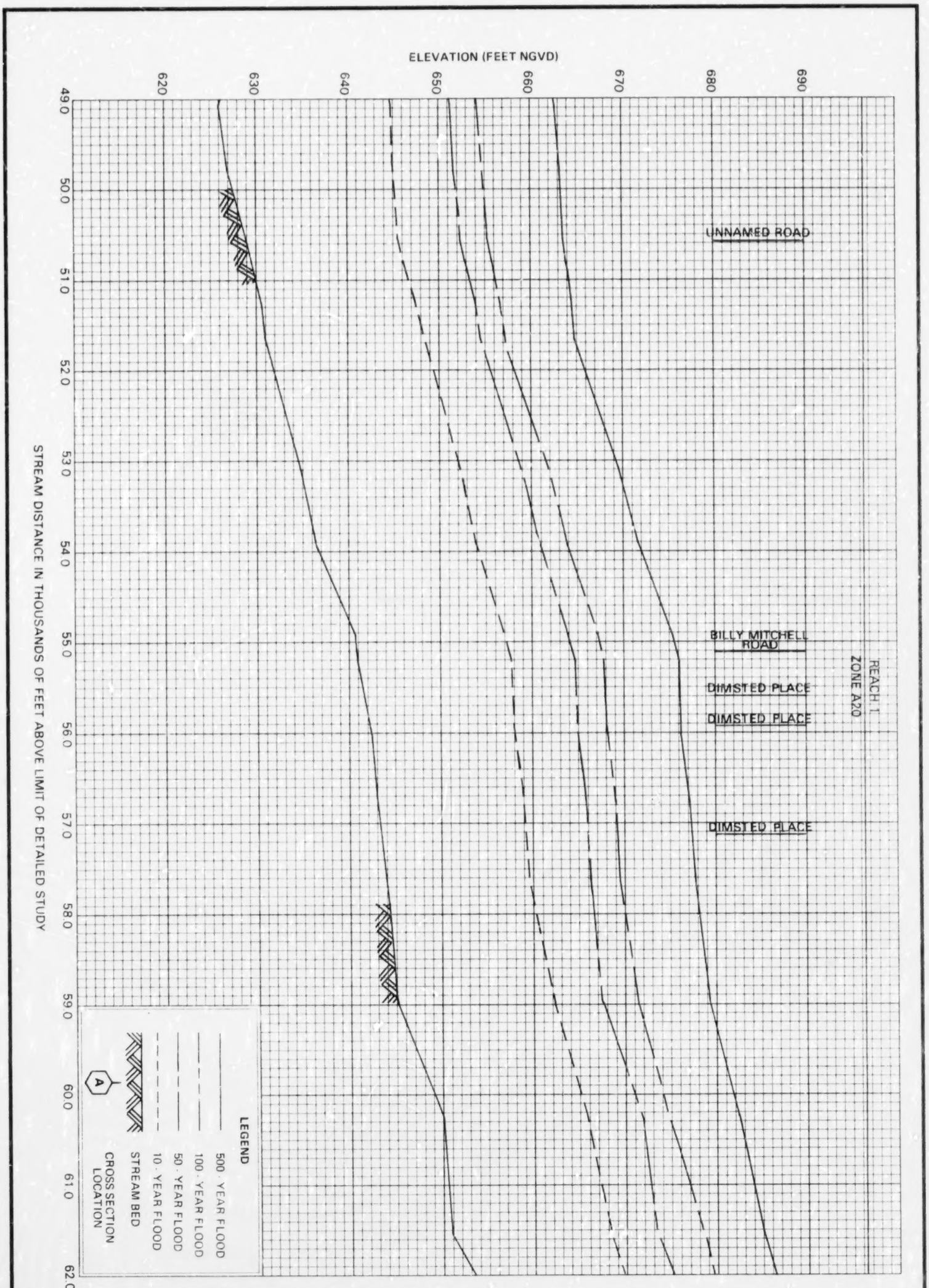
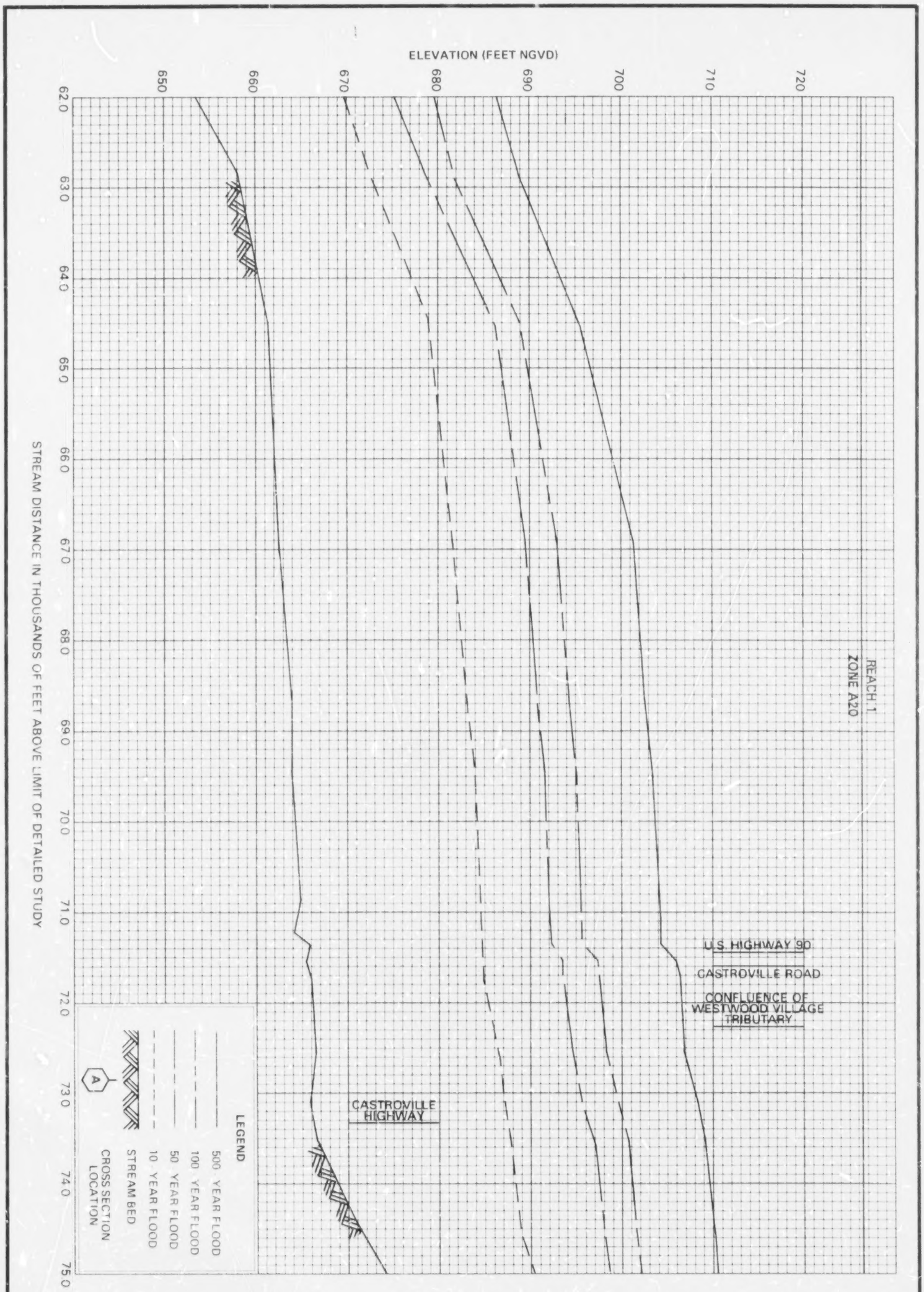


83P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES LEON CREEK

BEST COPY AVAILABLE



84P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

LEON CREEK

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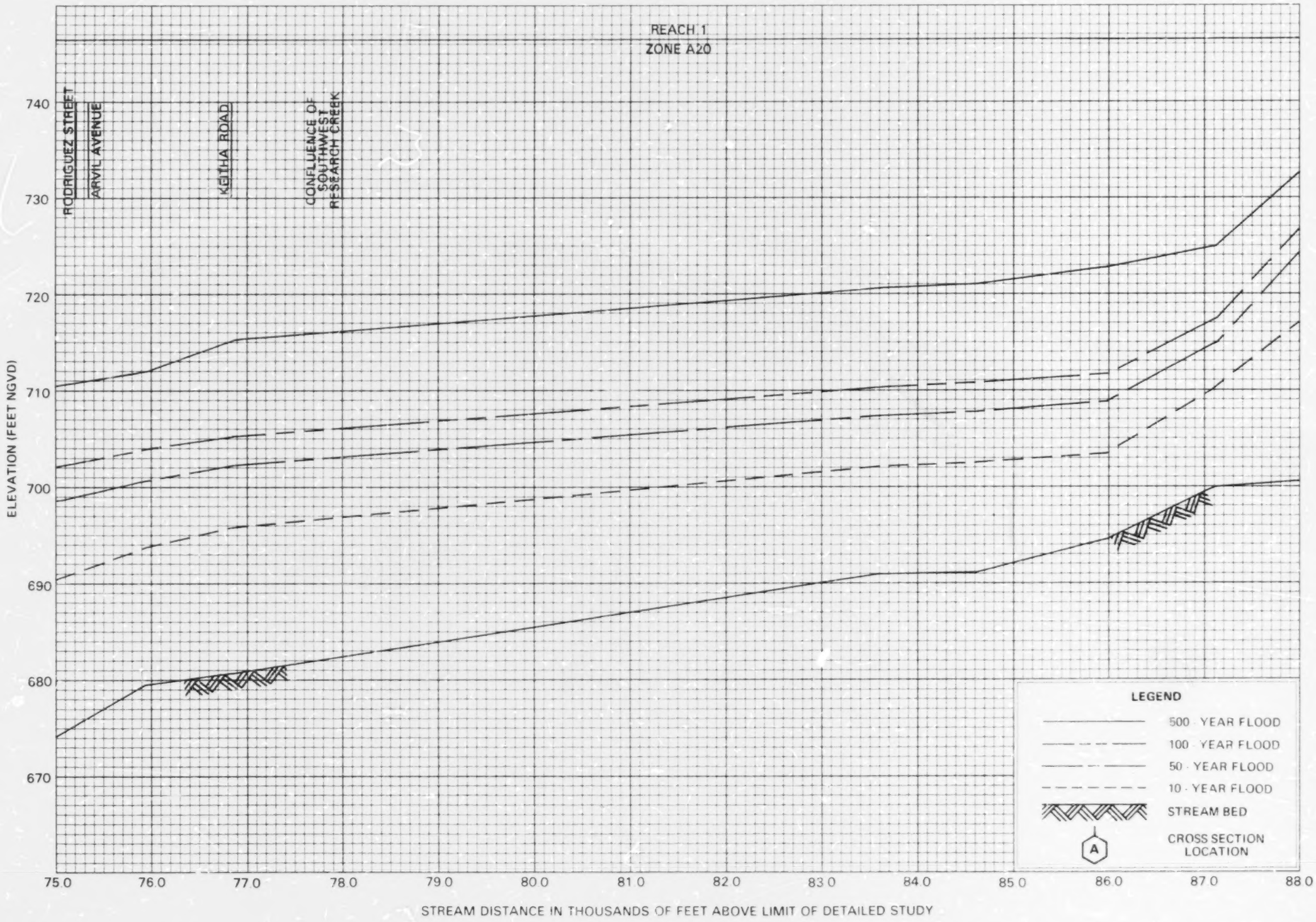

FLOOD PROFILES

LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

85P

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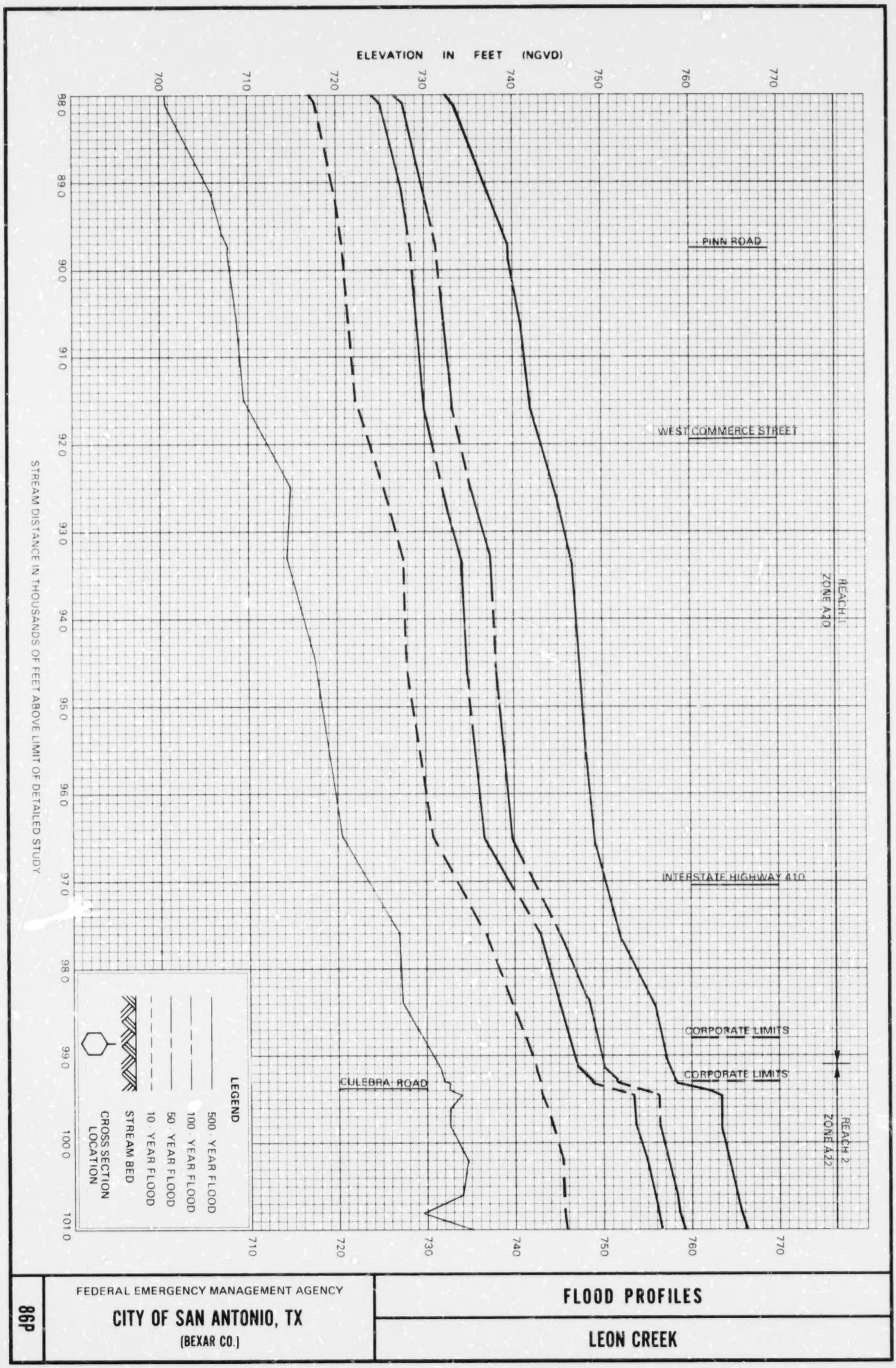

86P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

LEON CREEK

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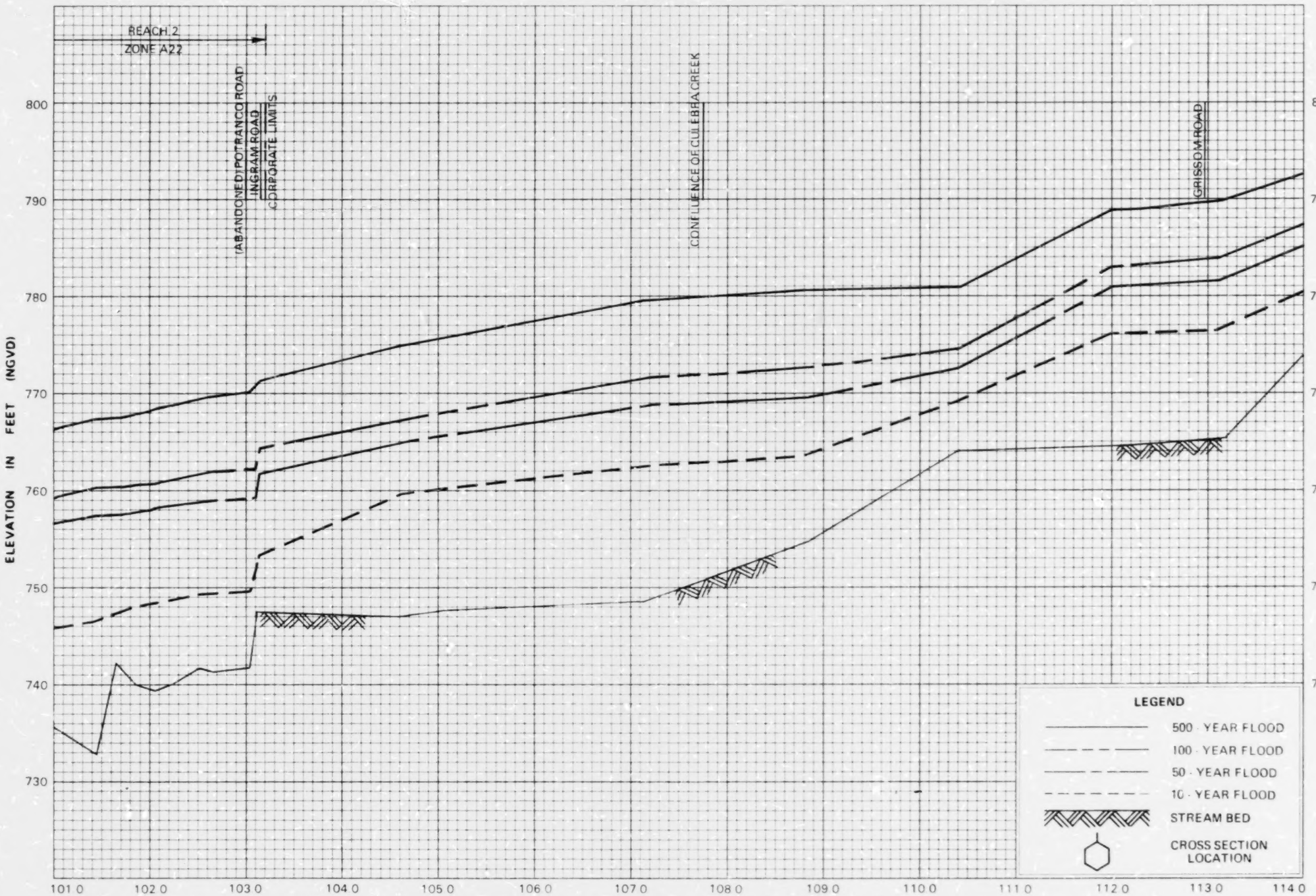

FLOOD PROFILES

LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

87P

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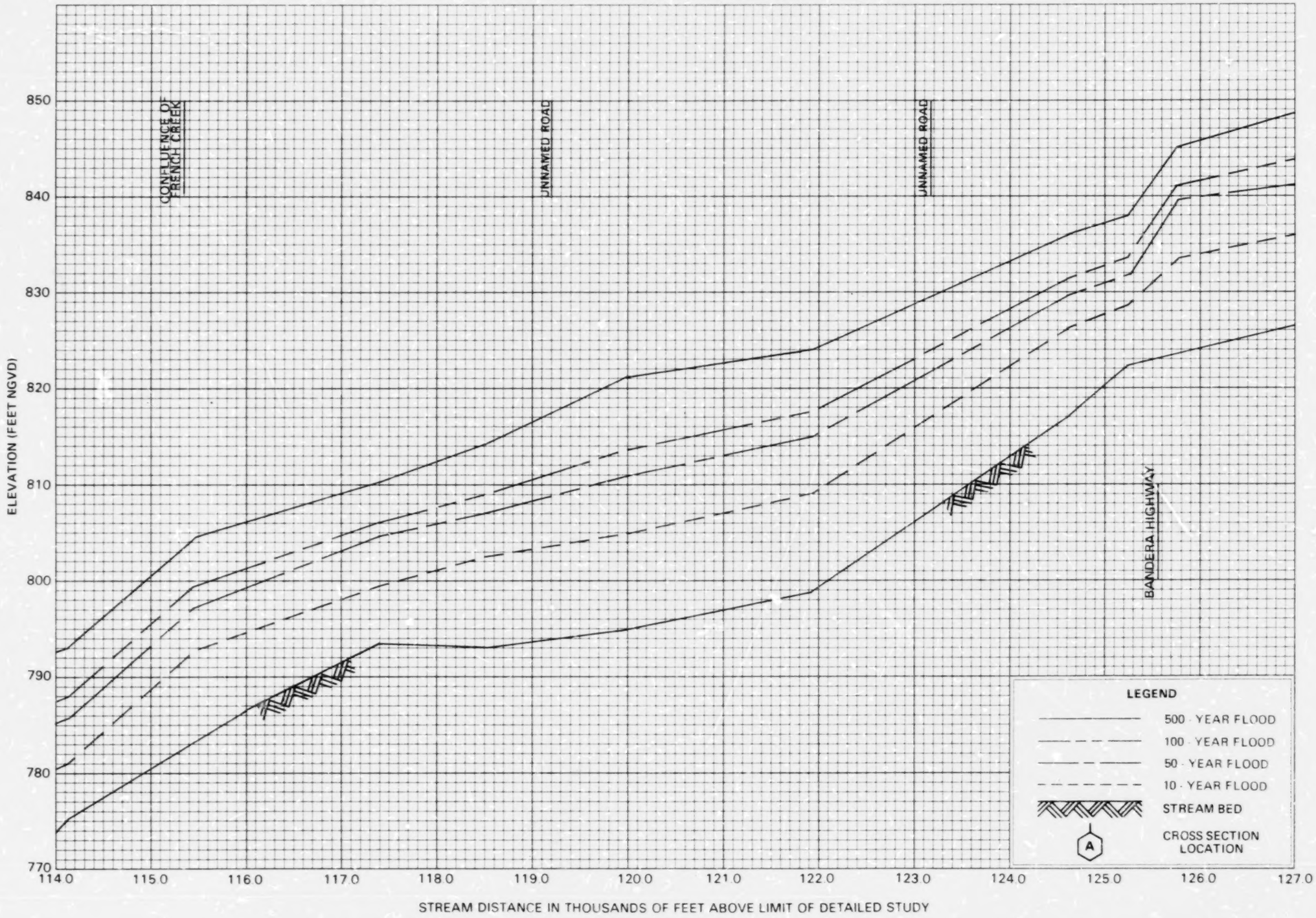

FLOOD PROFILES

LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

88P

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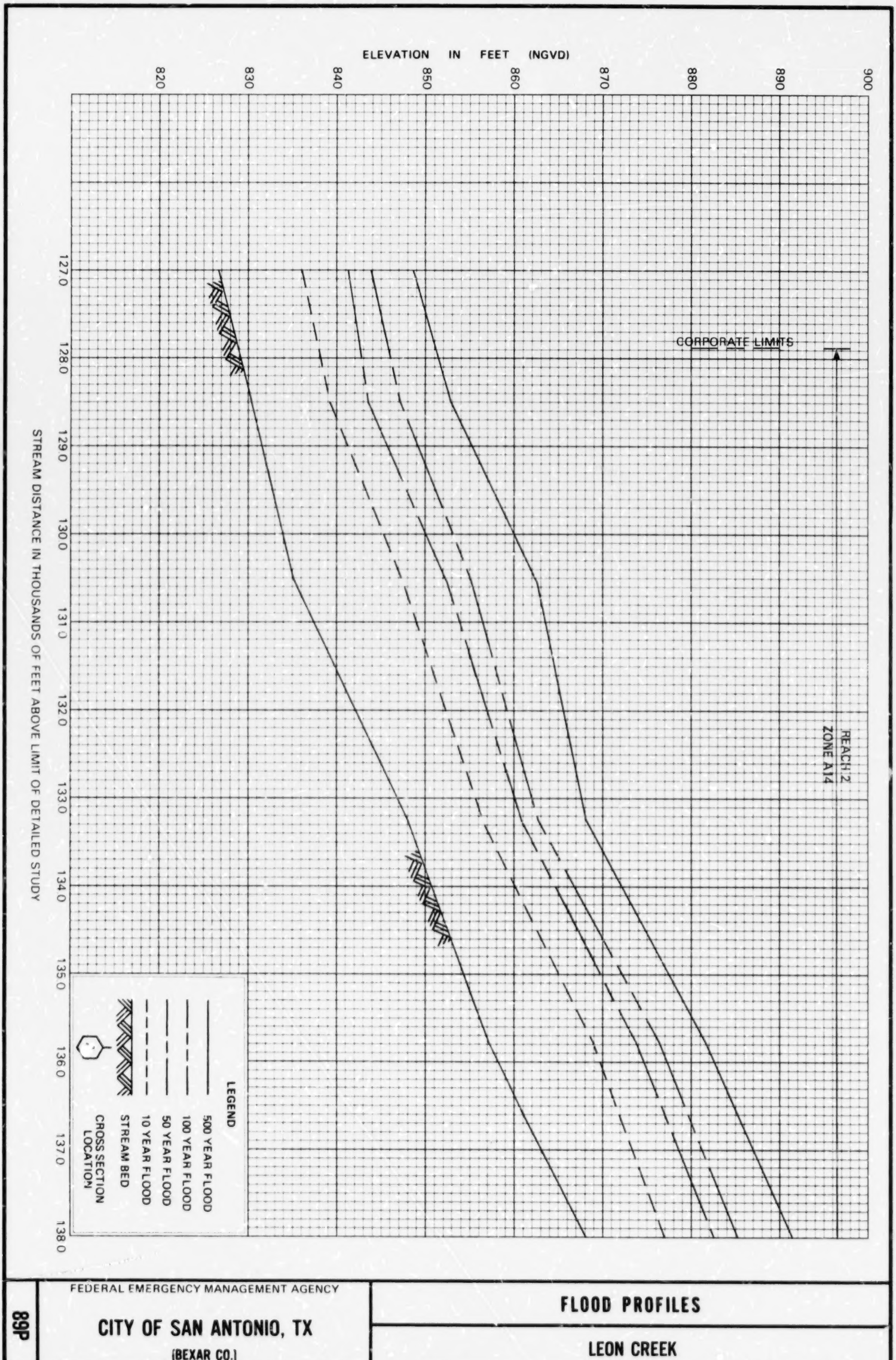

89P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES LEON CREEK

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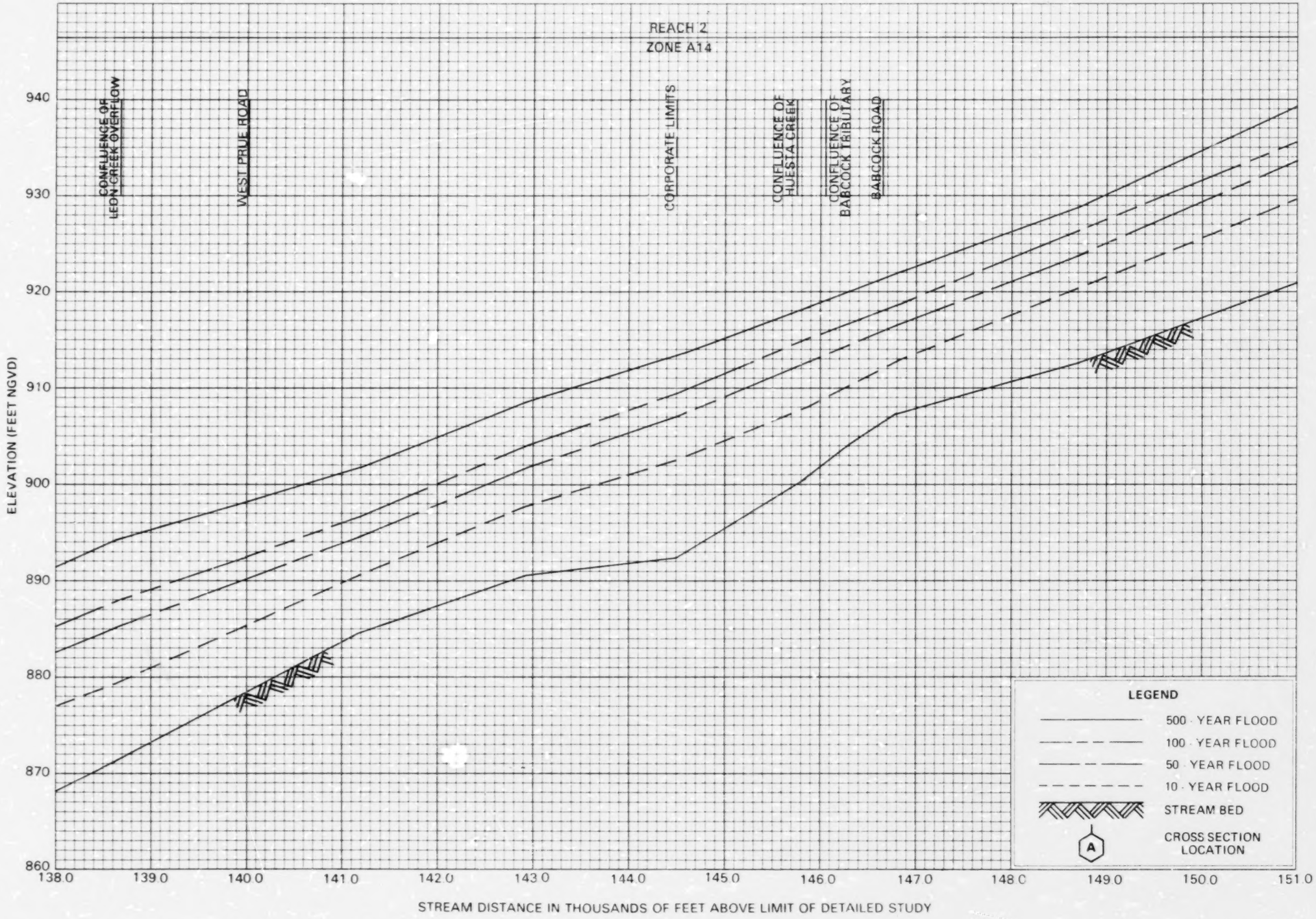

FLOOD PROFILES

LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

90P

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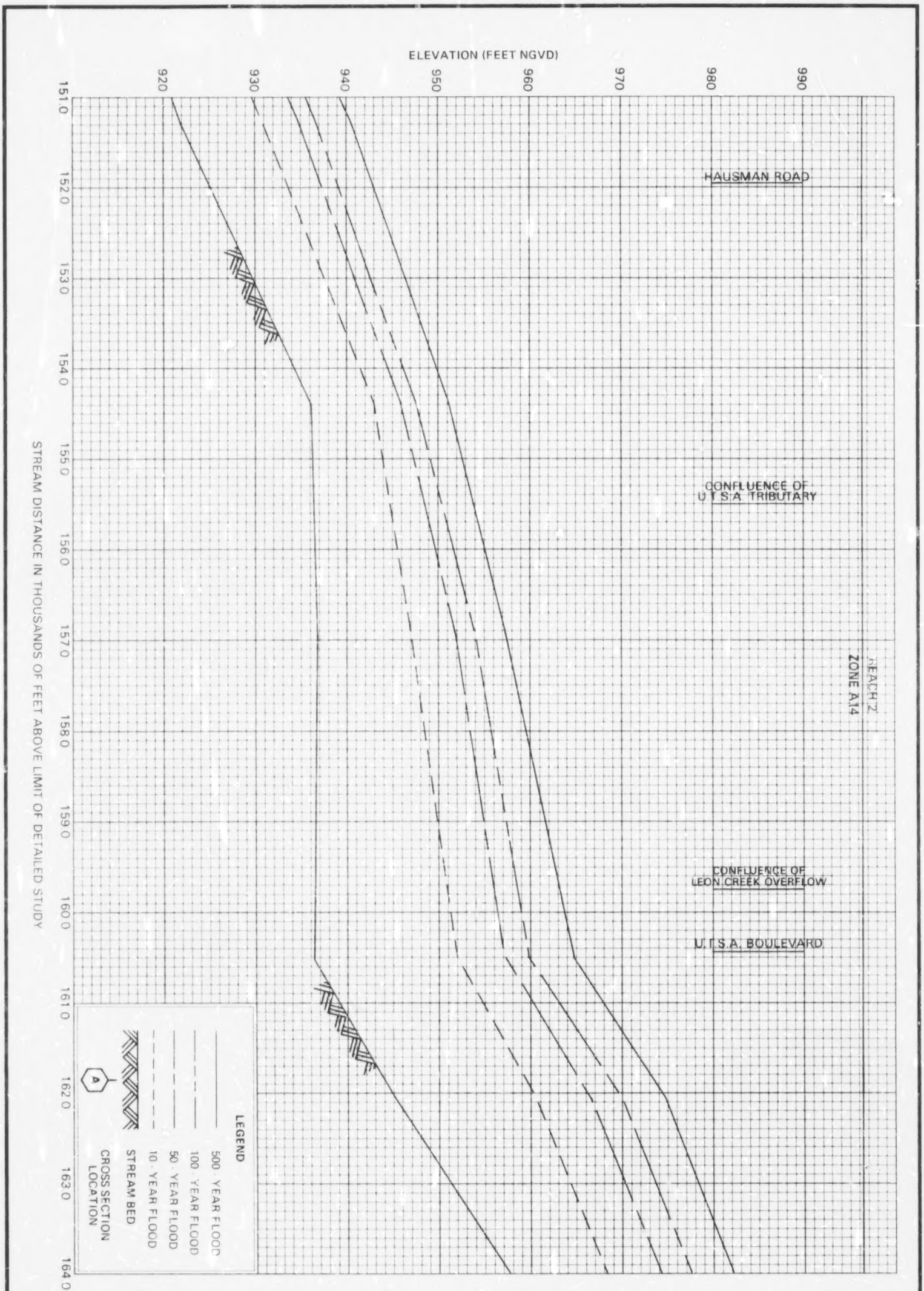


FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

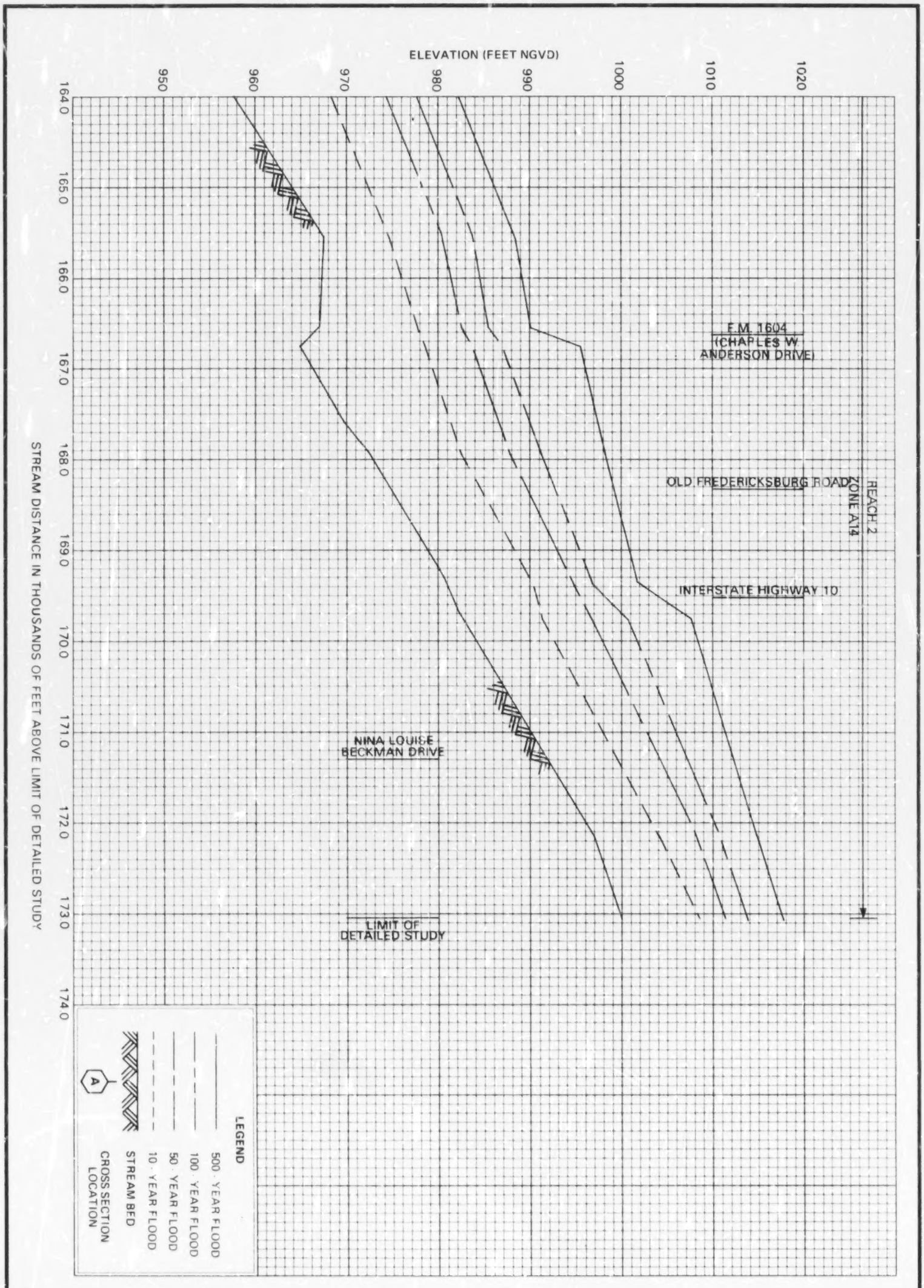
(BEXAR CO.)

FLOOD PROFILES

LEON CREEK

91P

BEST COPY AVAILABLE



92P

FEDERAL EMERGENCY MANAGEMENT AGENCY

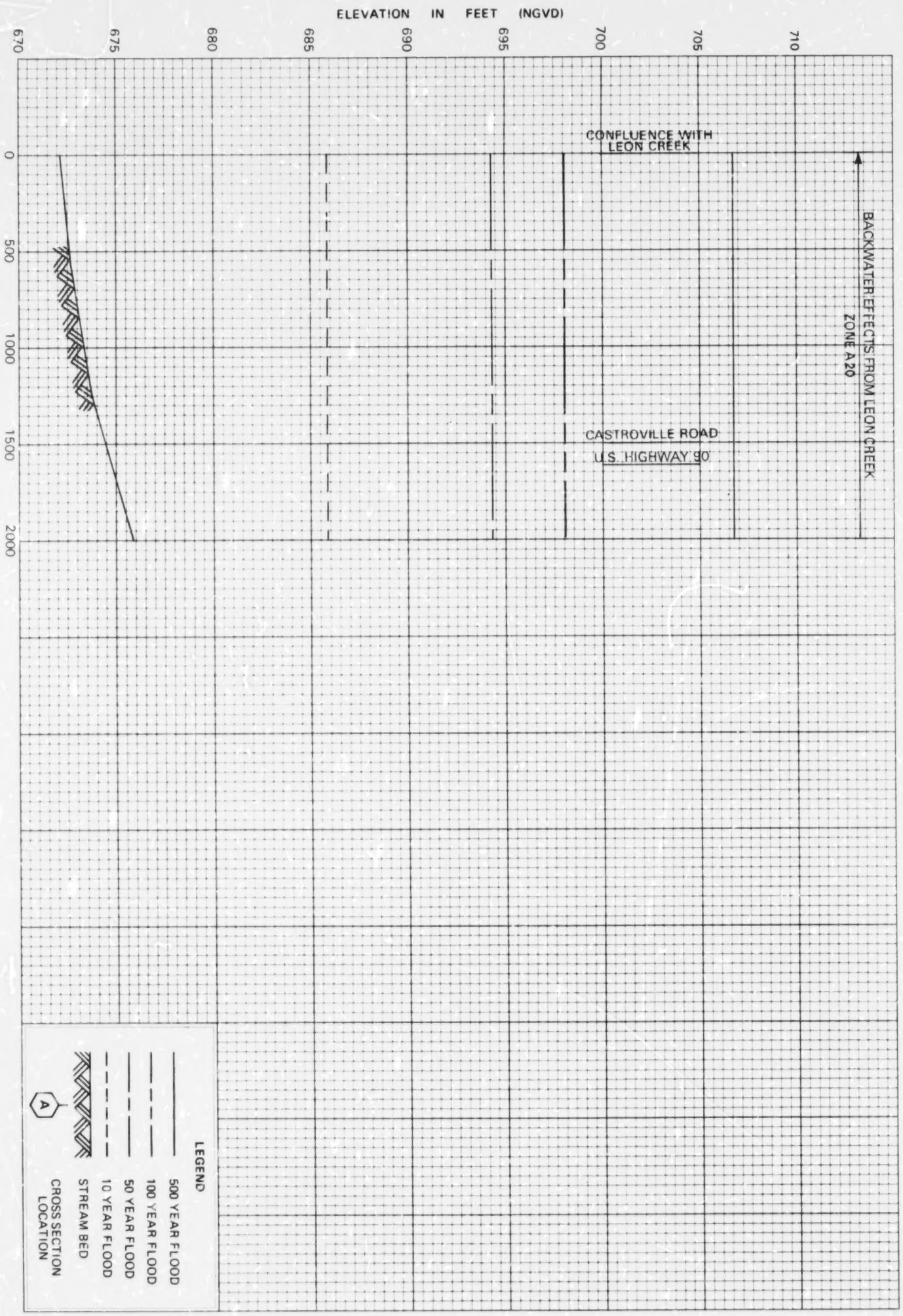
CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

LEON CREEK

BEST COPY AVAILABLE



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

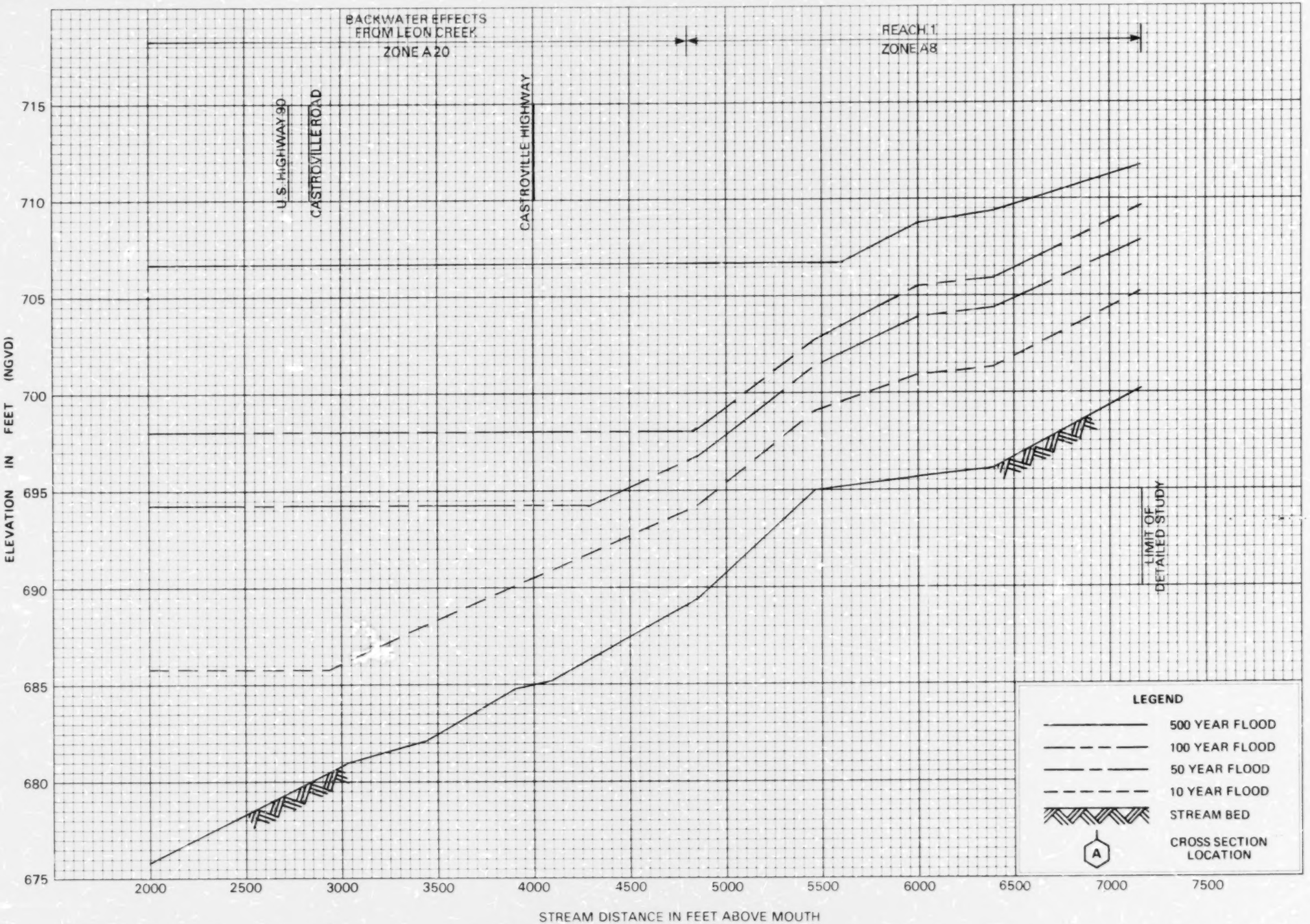
(BEXAR CO.)

FLOOD PROFILES

WESTWOOD VILLAGE CREEK

93P

BEST COPY AVAILABLE



FLOOD PROFILES

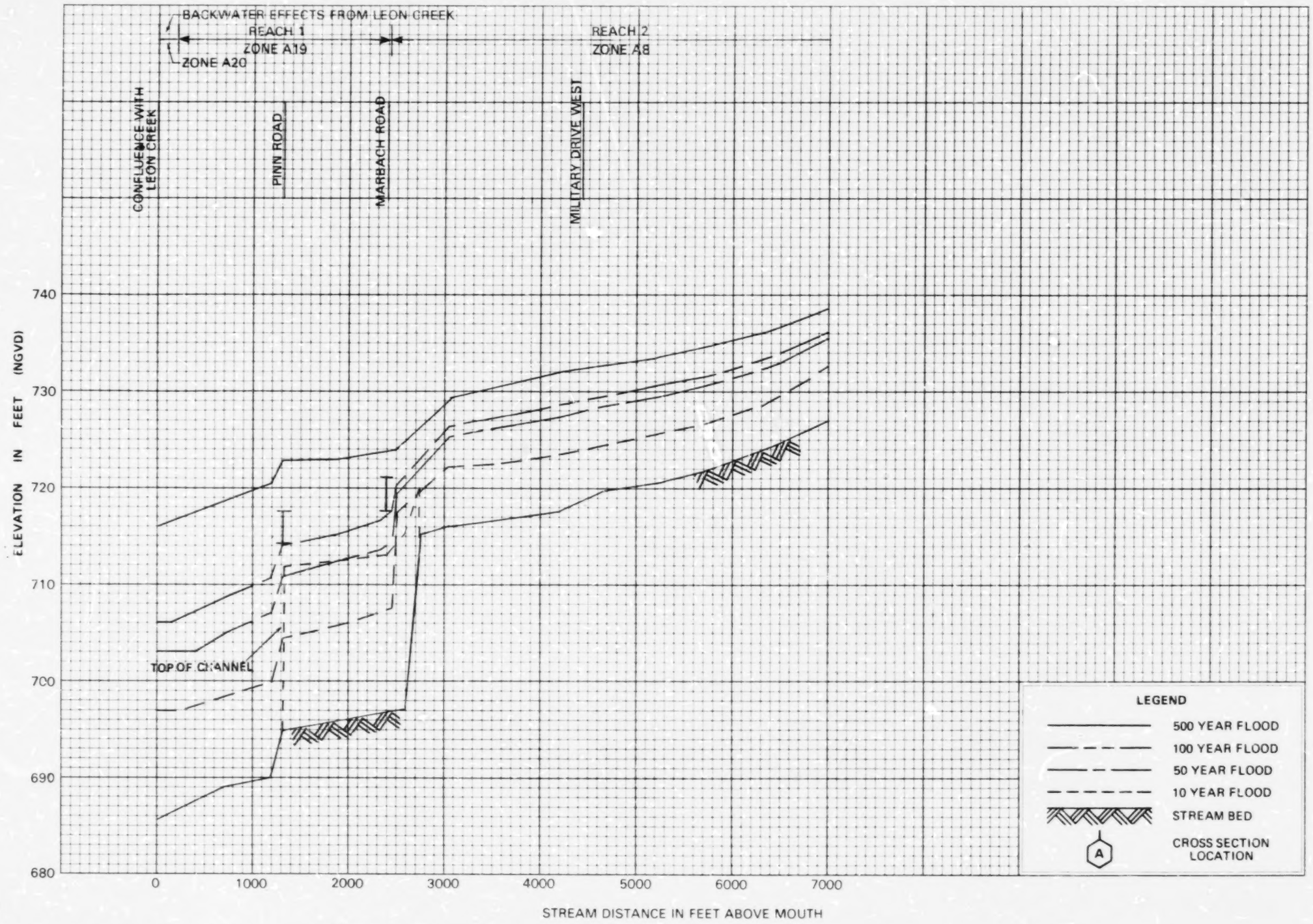
WESTWOOD VILLAGE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

94P

BEST COPY AVAILABLE



FLOOD PROFILES

SOUTHWEST RESEARCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

95P

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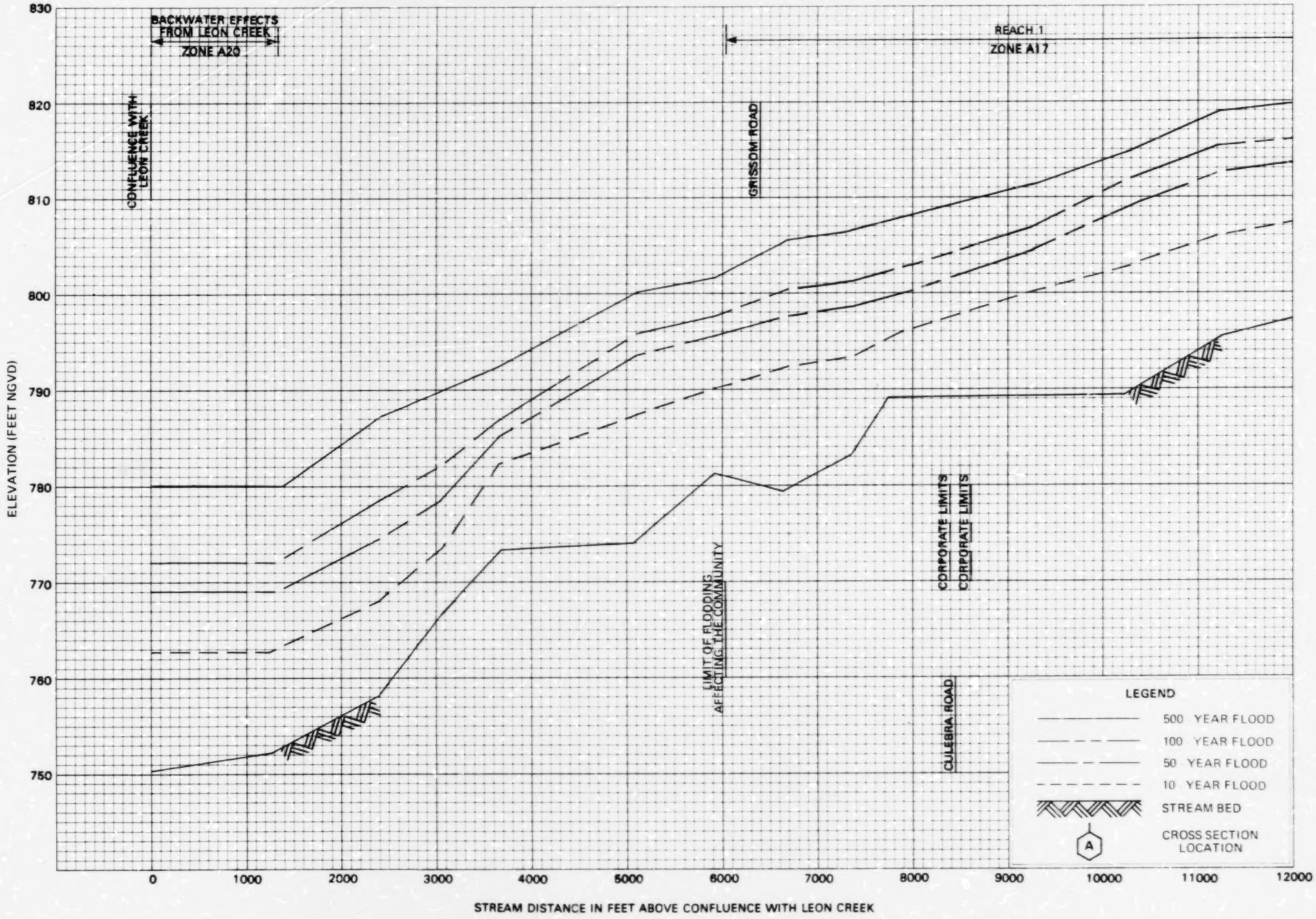

FLOOD PROFILES

CULEBRA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

97P

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FLOOD PROFILES

CULEBRA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

98P

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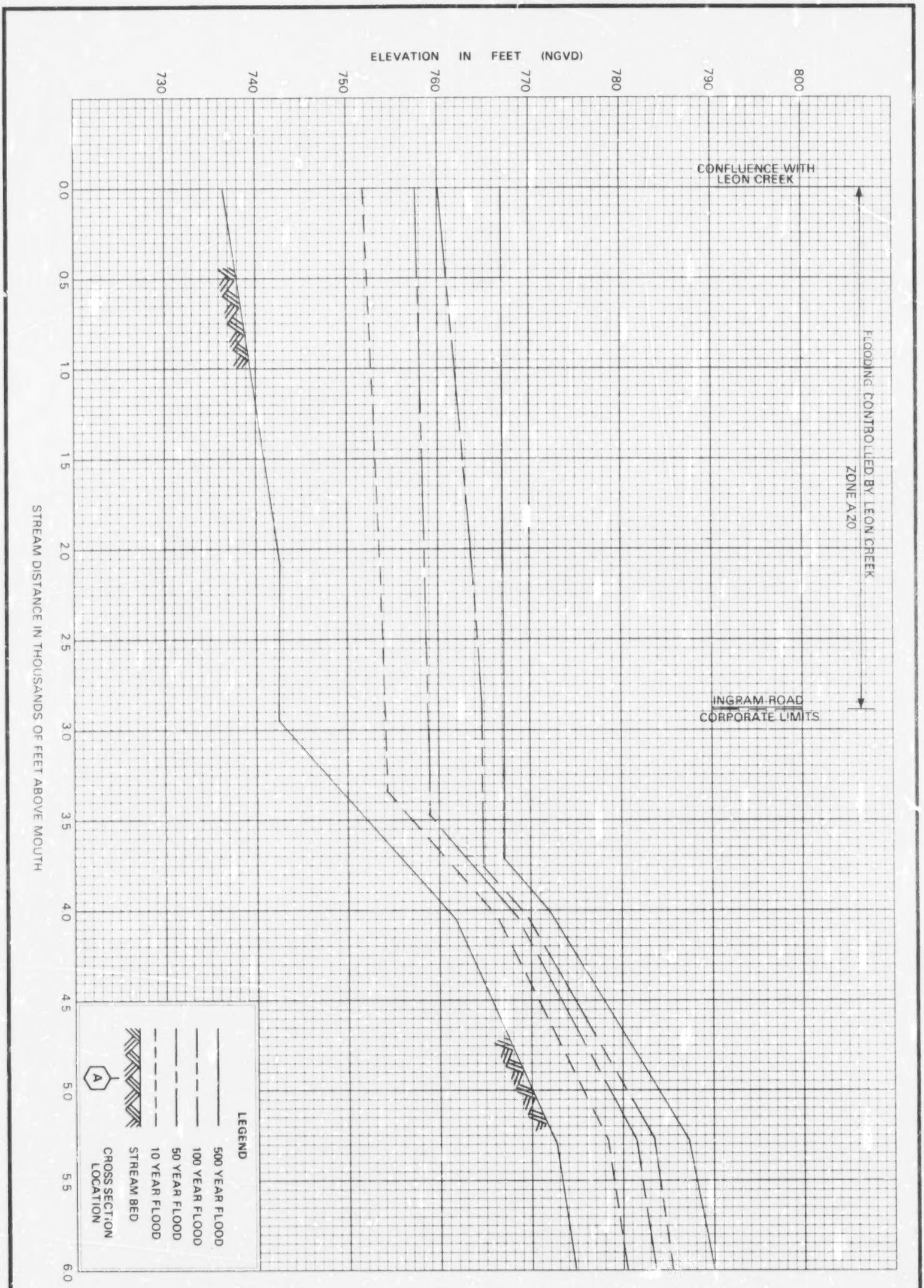

99P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

HUEBNER CREEK

1.34

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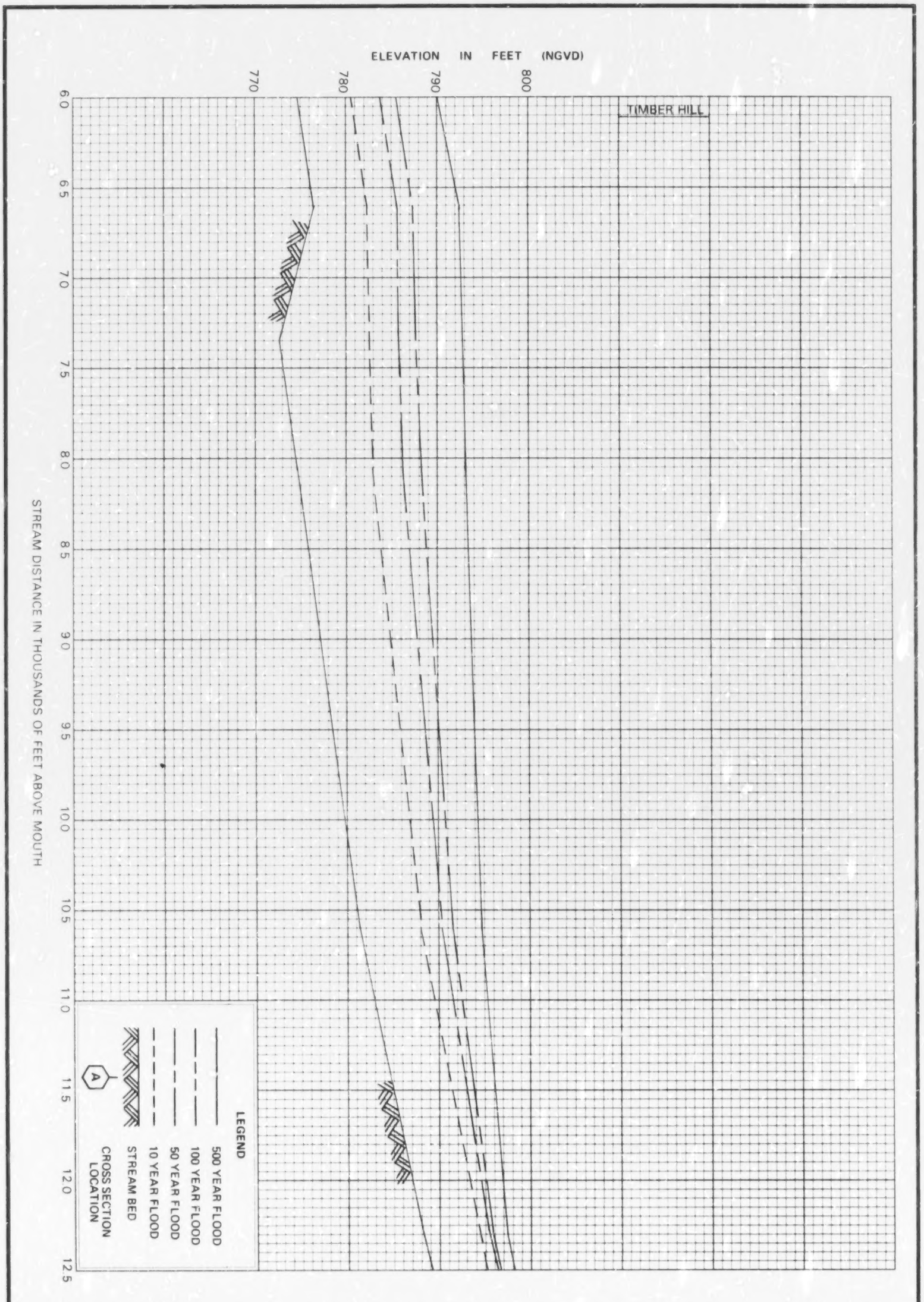

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

HUEBNER CREEK

100P

125

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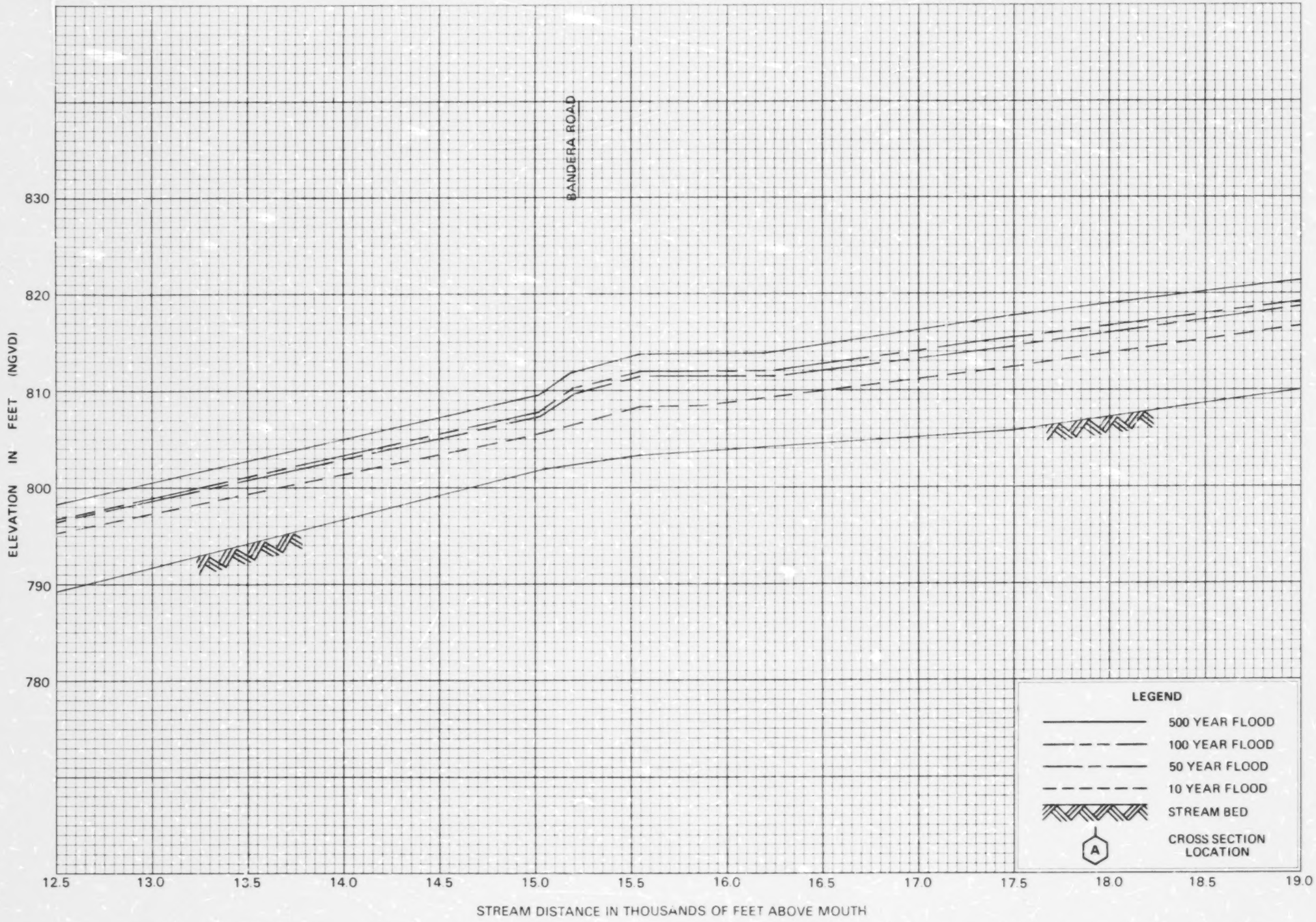

FLOOD PROFILES

HUEBNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

101P

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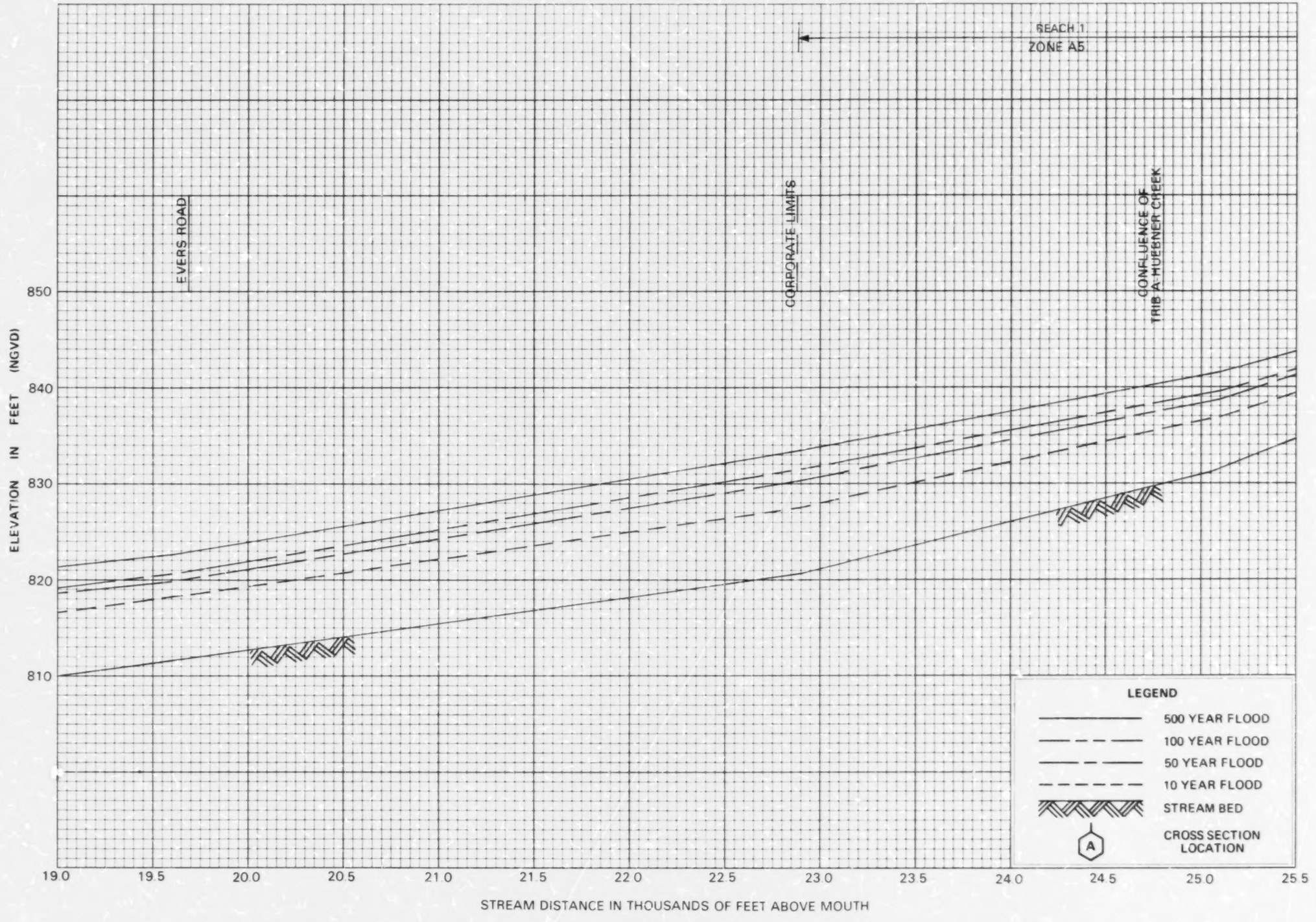

FLOOD PROFILES

HUEBNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

102P

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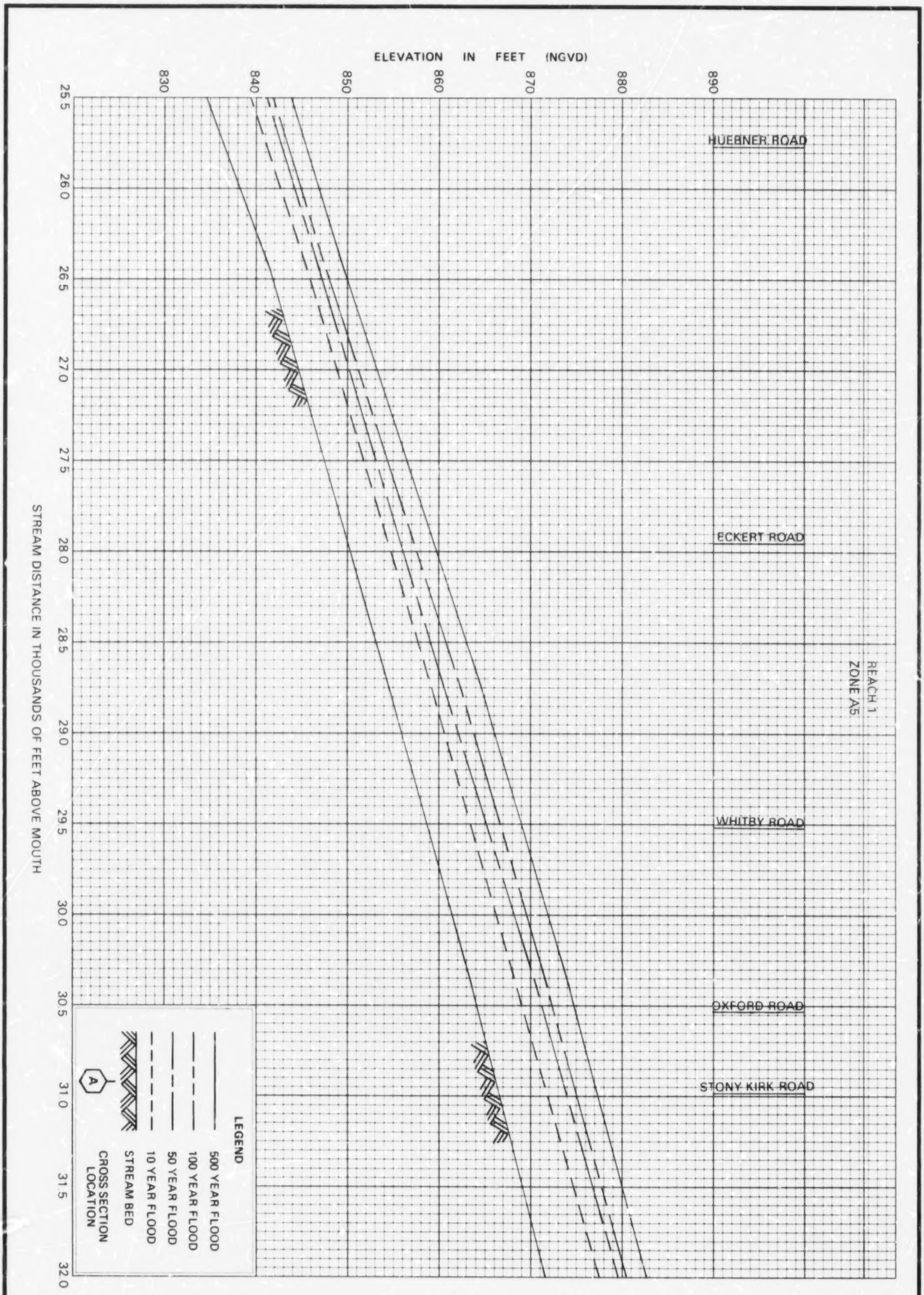
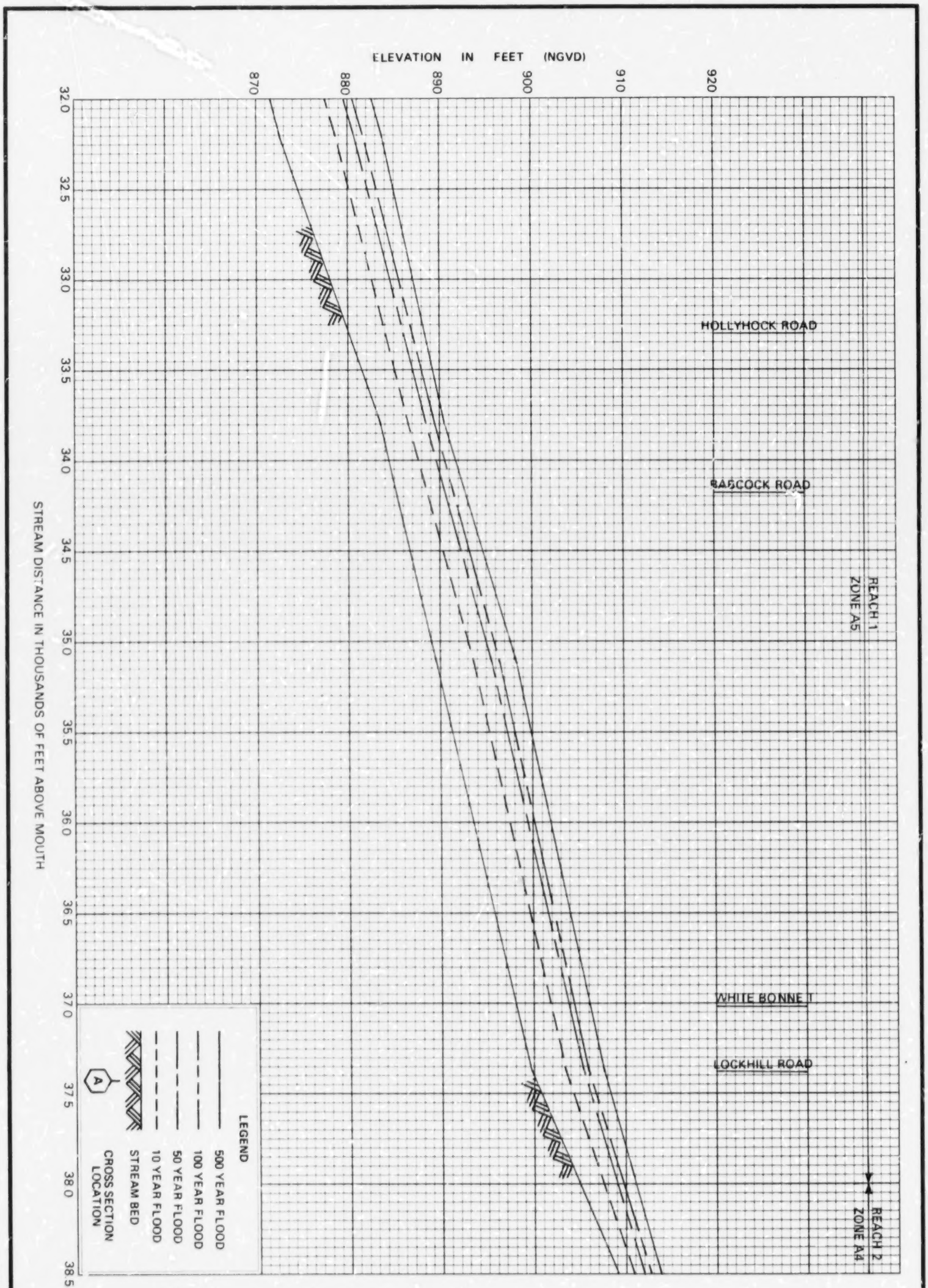


103P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES HUEBNER CREEK

BEST COPY AVAILABLE



104P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES HUEBNER CREEK

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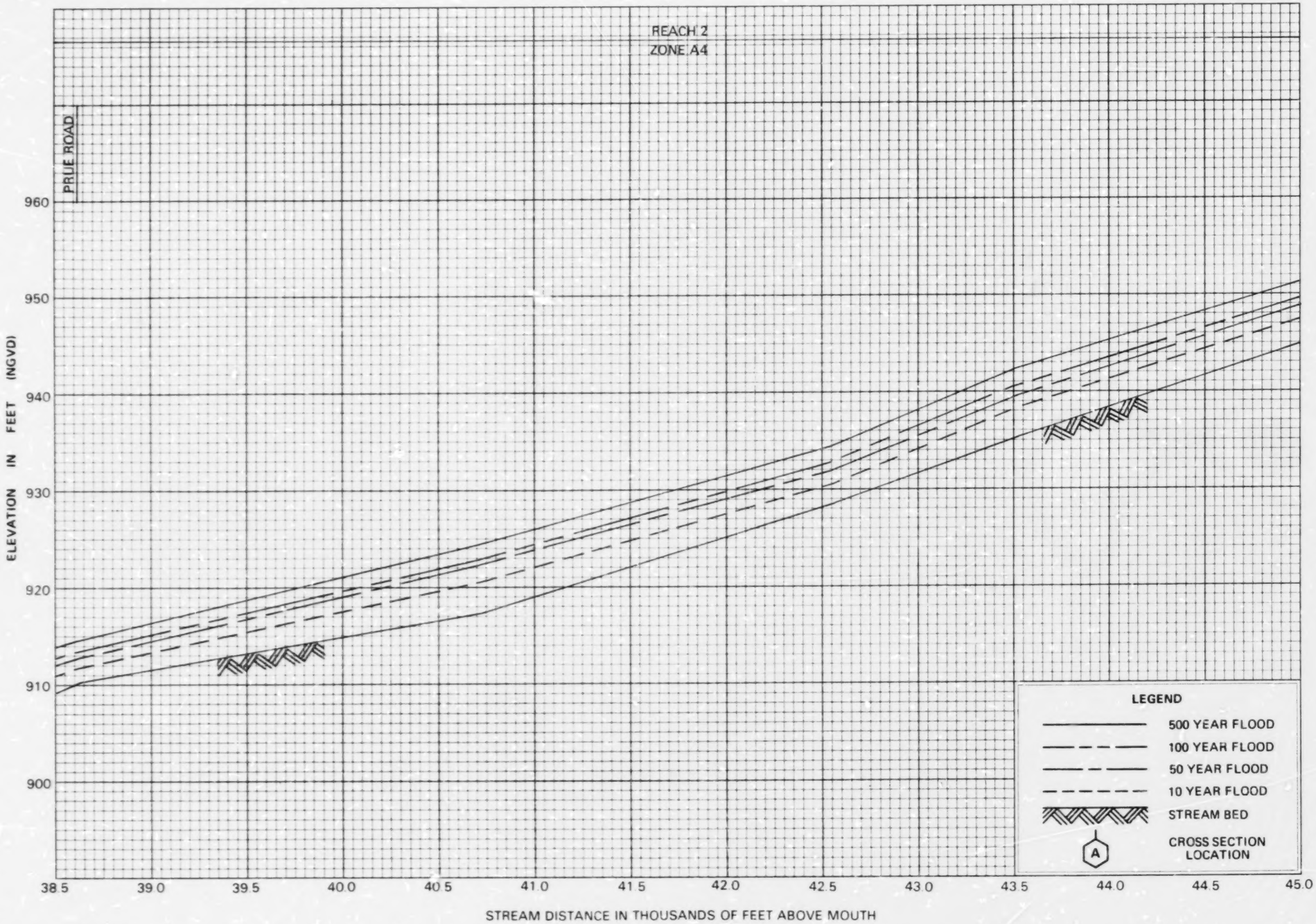

FLOOD PROFILES

HUEBNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

105P

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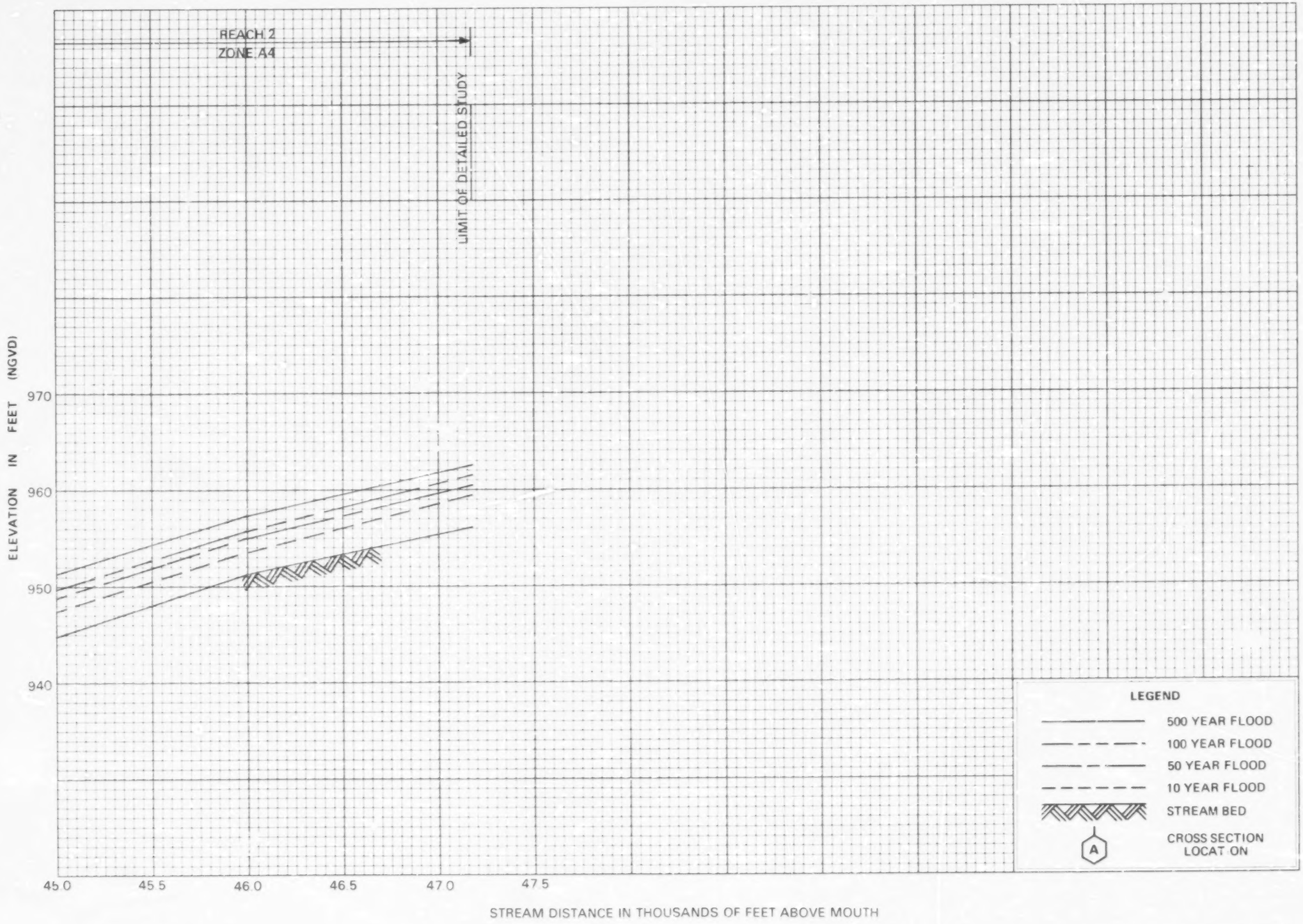

FLOOD PROFILES

HUEBNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

106P

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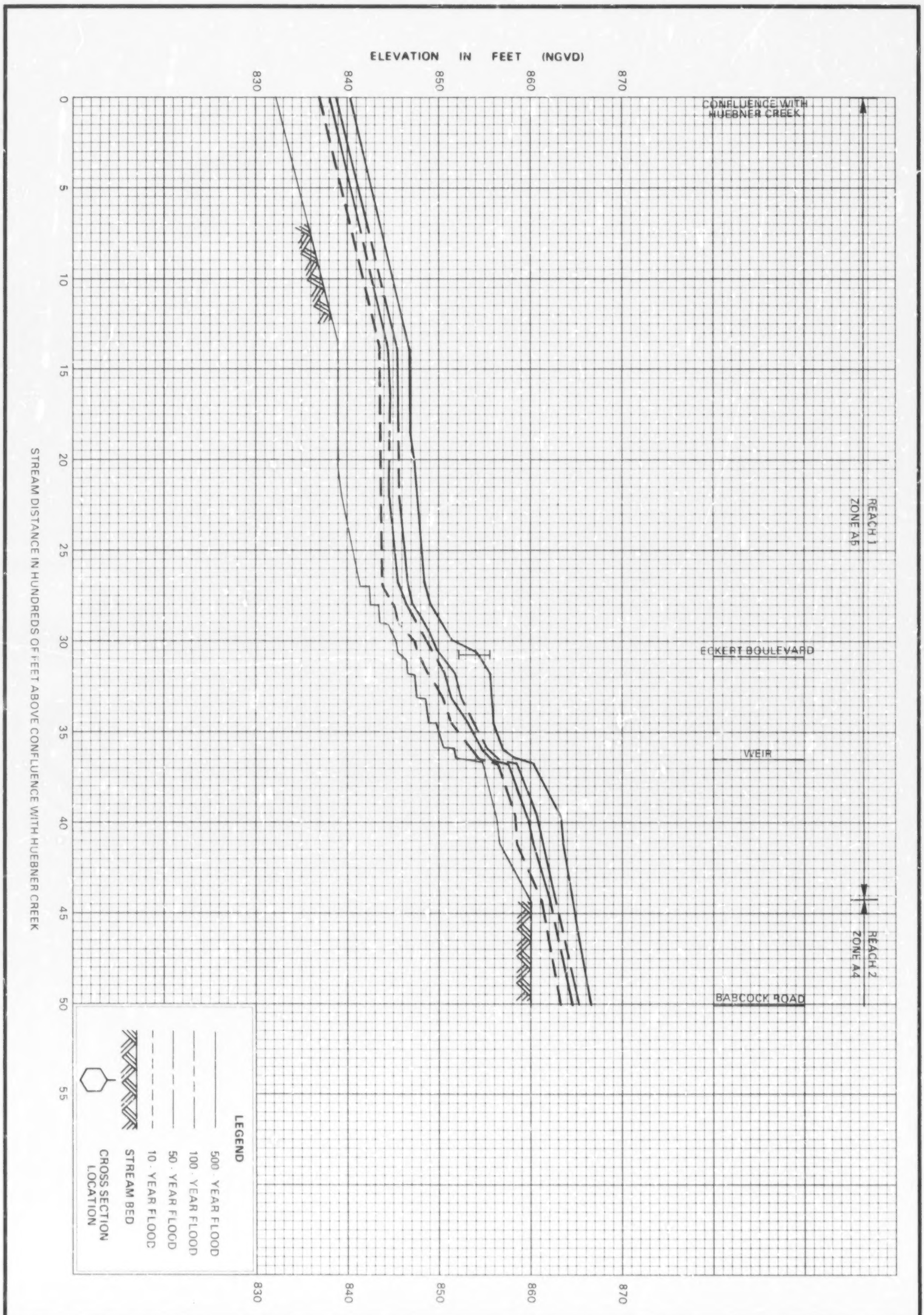

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

107P

FLOOD PROFILES

HUEBNER CREEK - TRIBUTARY A

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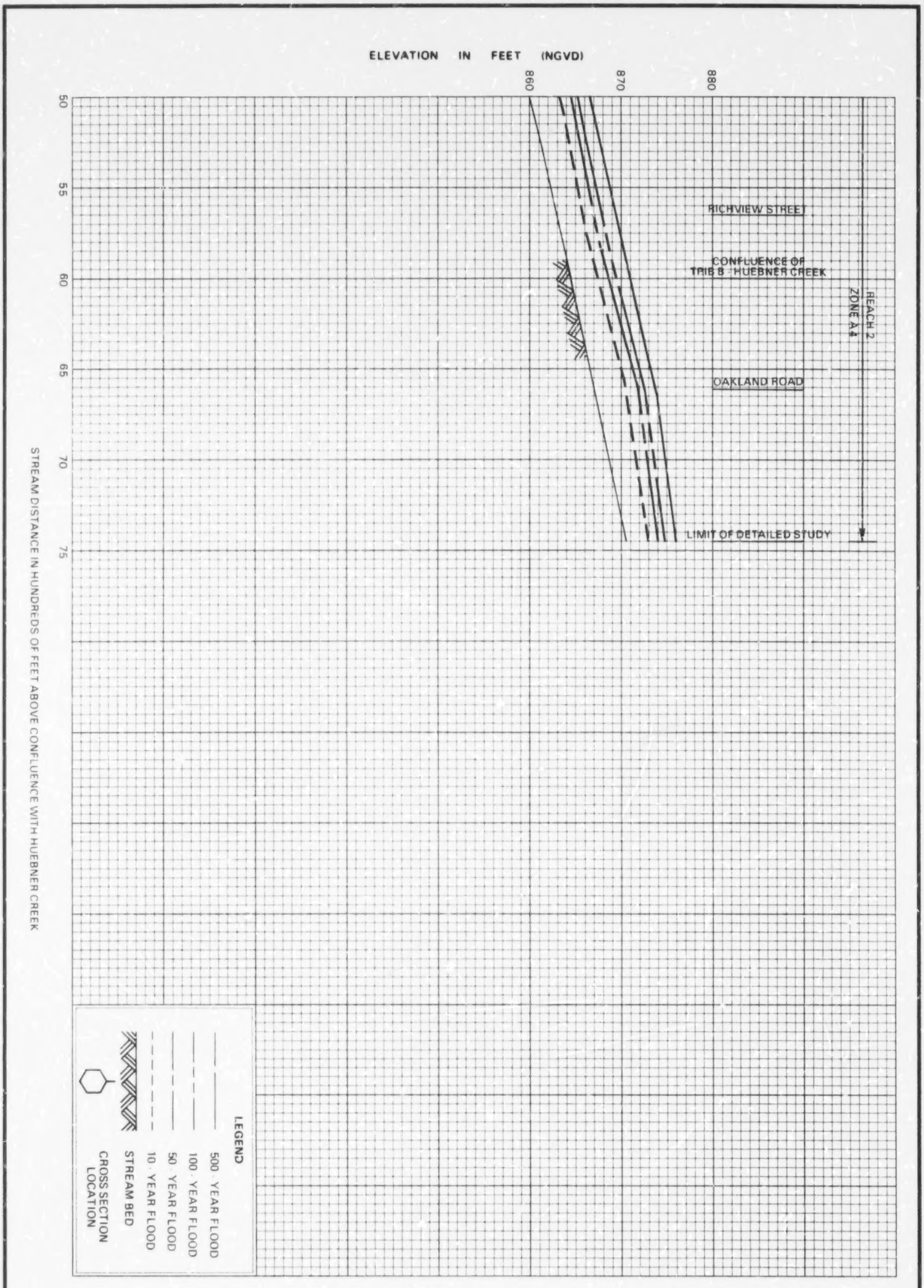

108P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES HUEBNER CREEK - TRIBUTARY A

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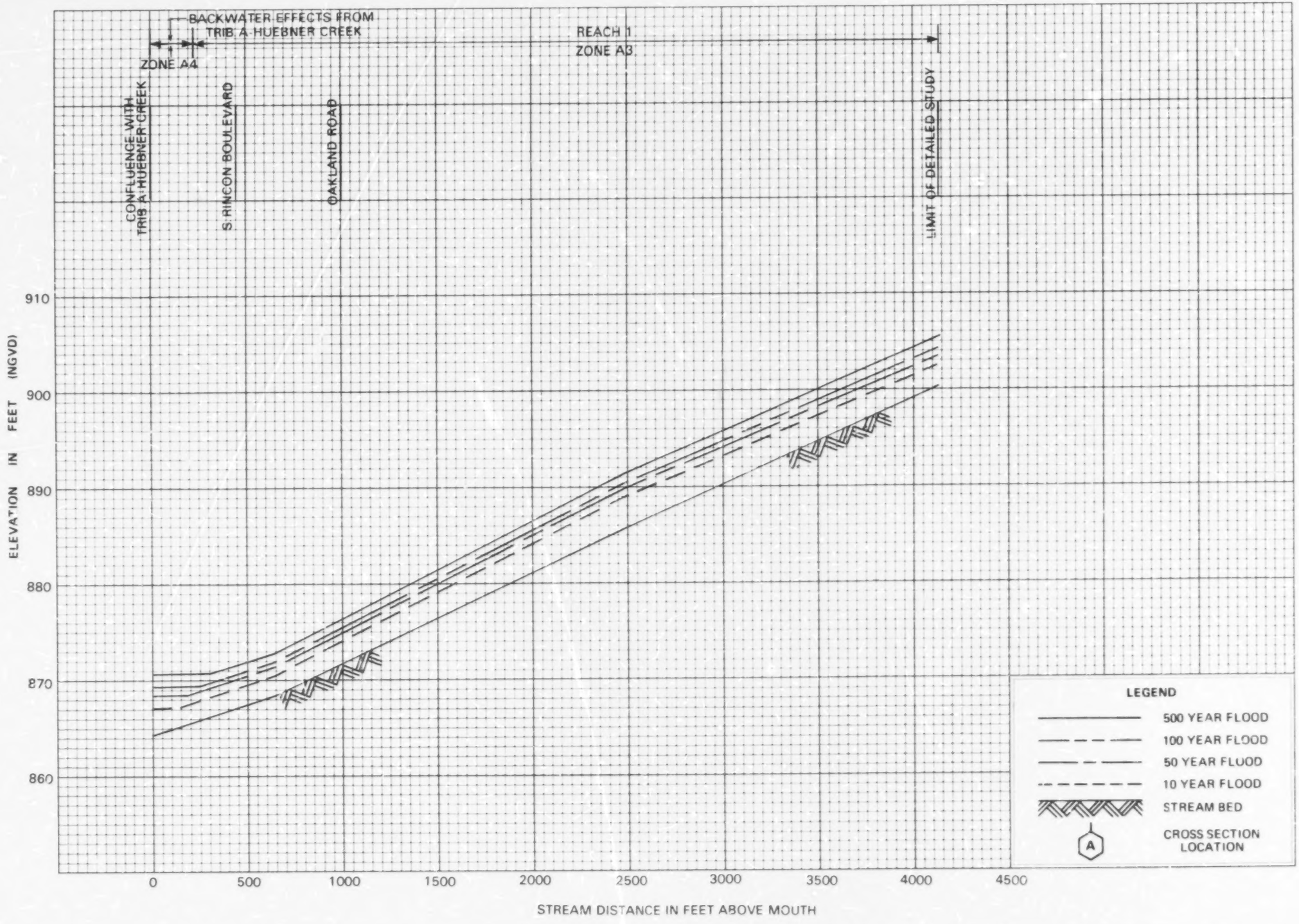

FLOOD PROFILES

TRIB. B-HUEBNER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

109P

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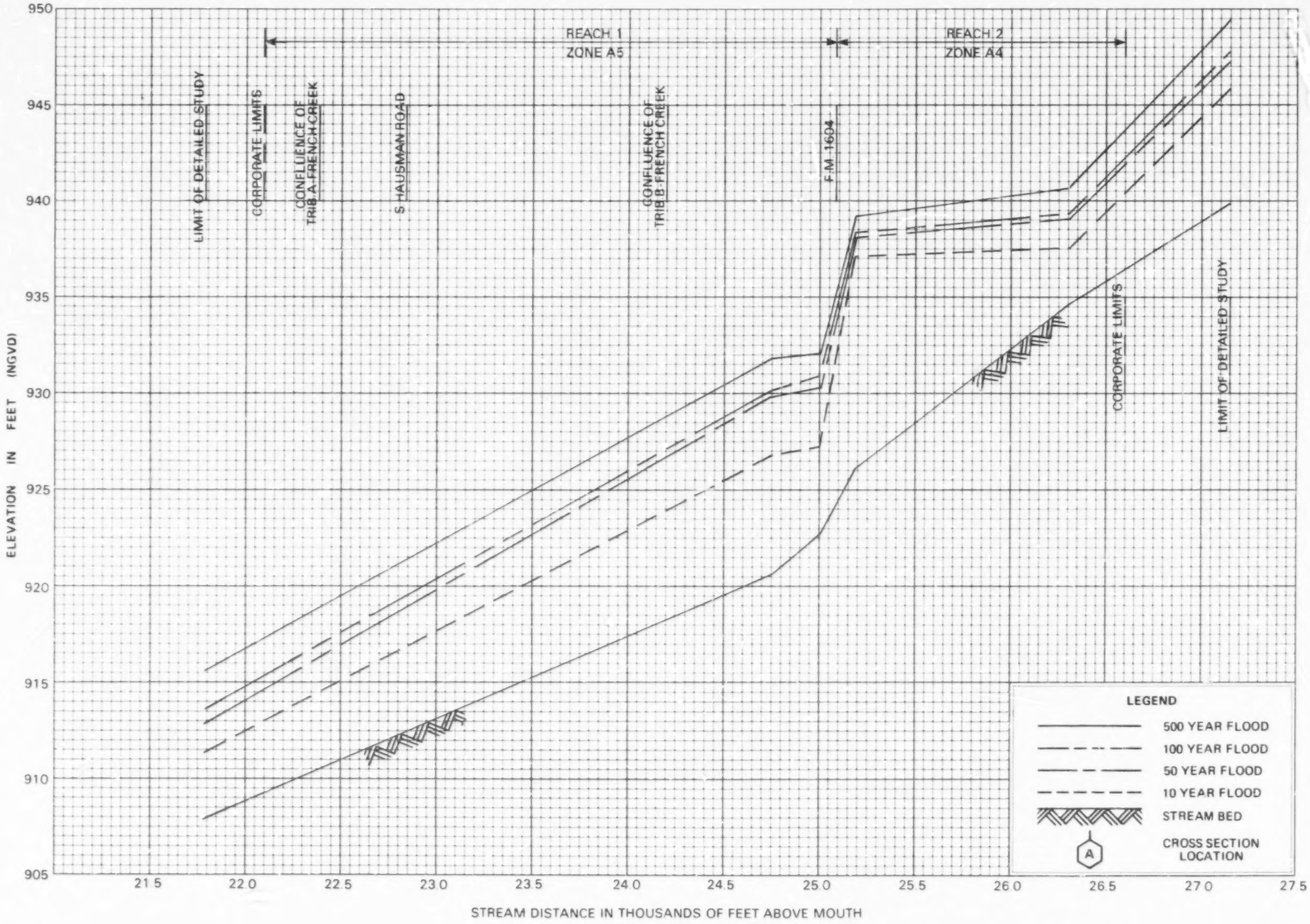

FLOOD PROFILES

FRENCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

110P

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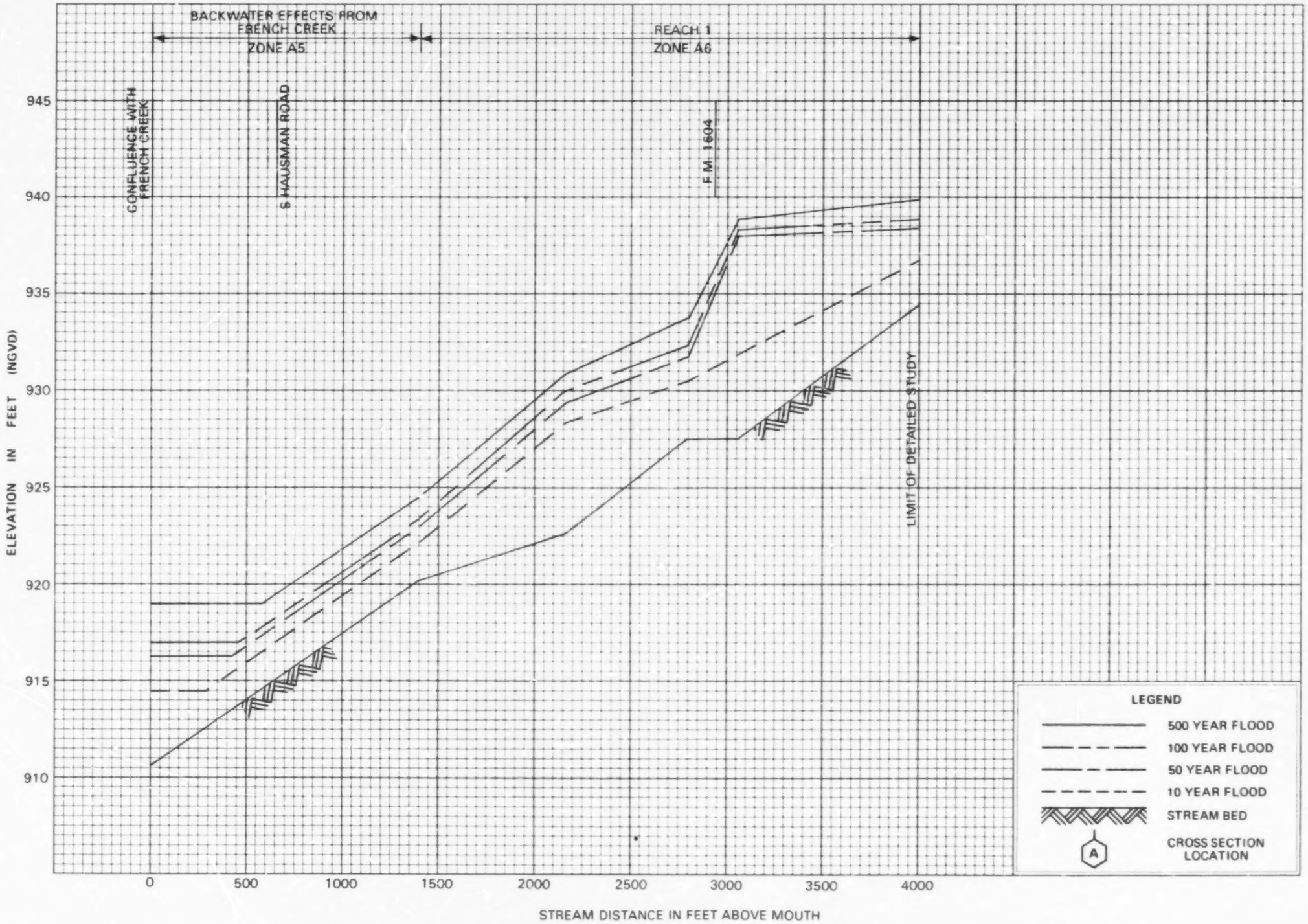

FLOOD PROFILES

TRIB A-FRENCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

111P

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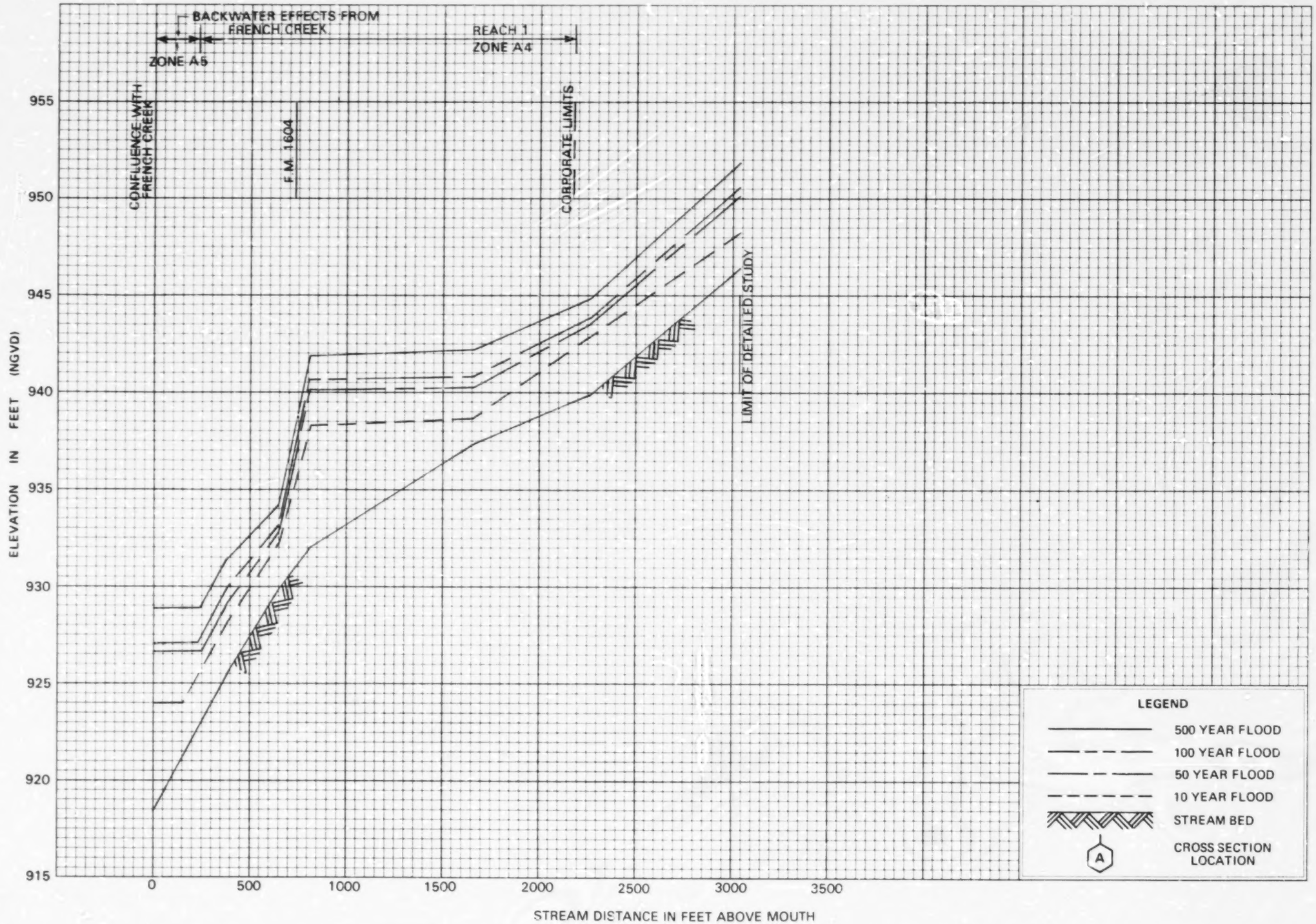

FLOOD PROFILES

TRIB B-FRENCH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

112P

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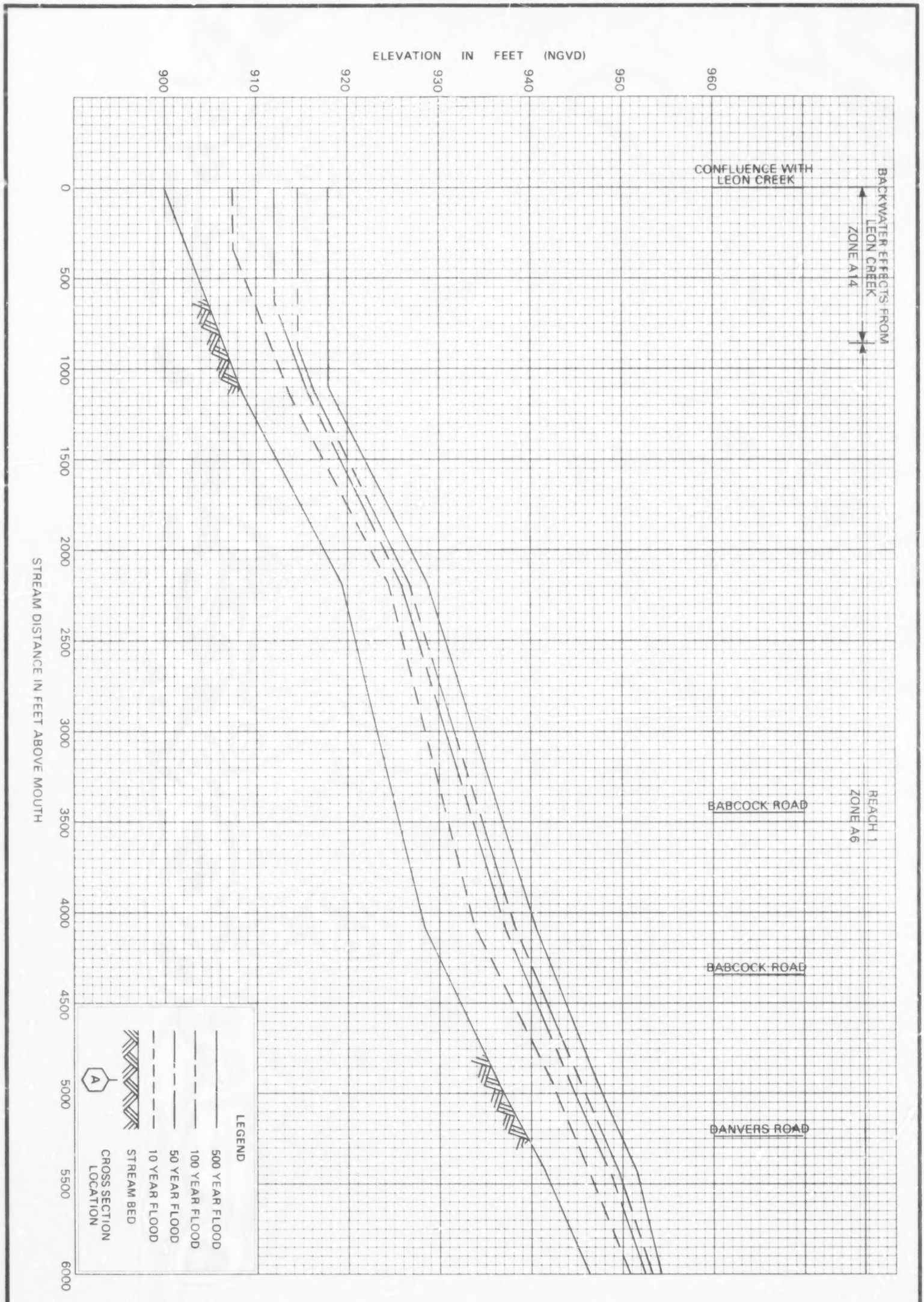

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

FLOOD PROFILES

HUESTA CREEK

113P

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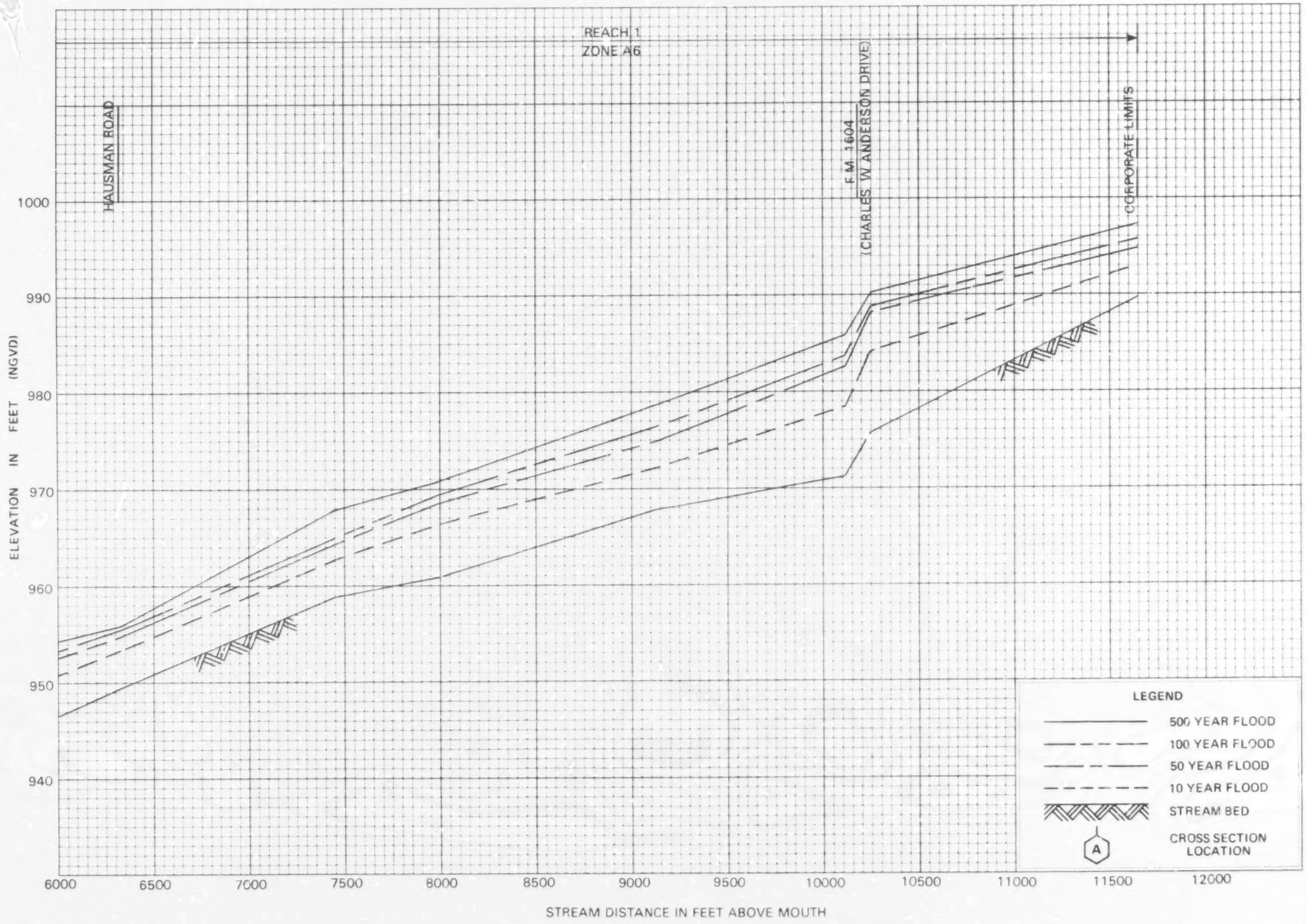

FLOOD PROFILES

HUESTA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

114P

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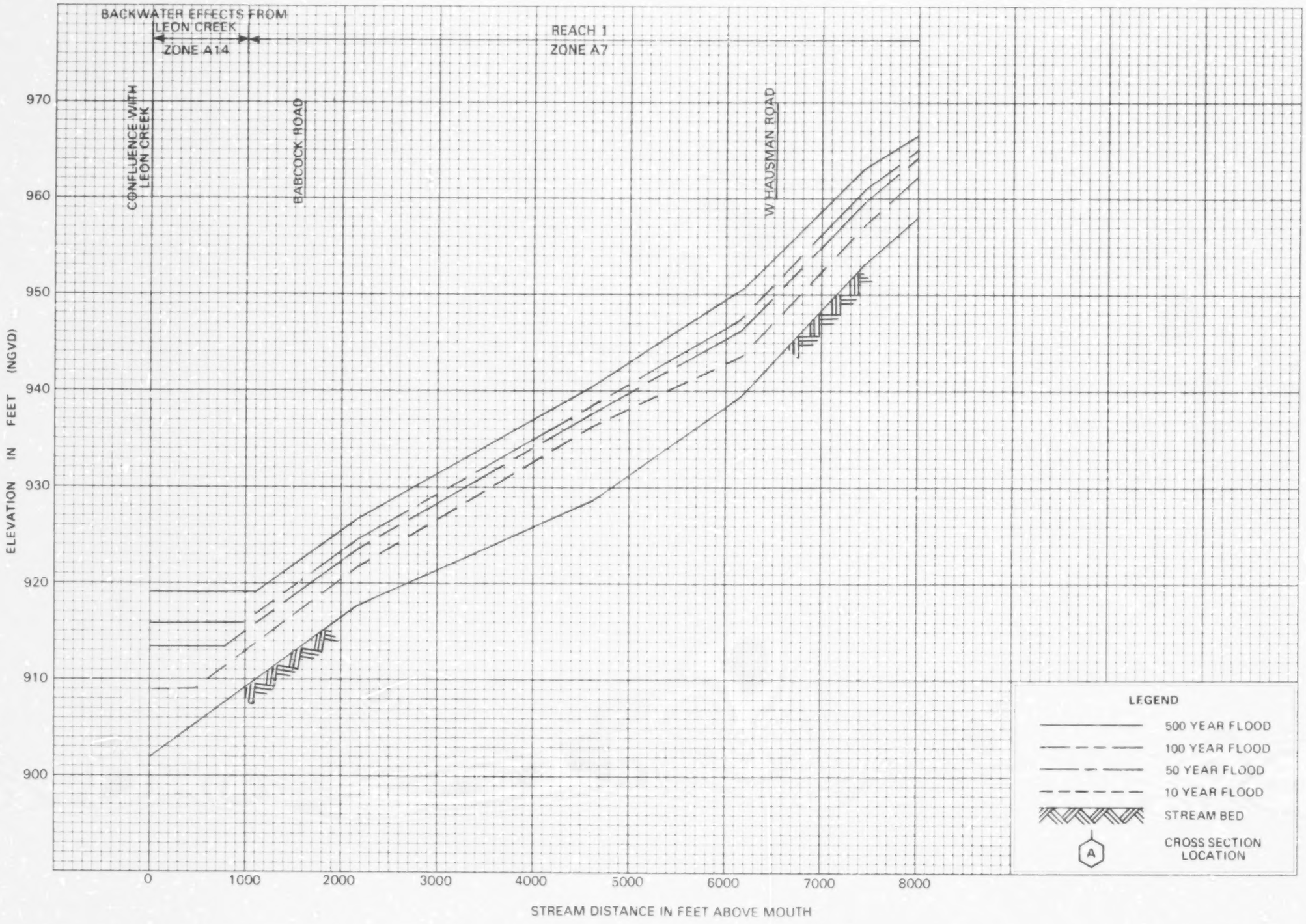

FLOOD PROFILES

BABCOCK TRIB-LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX

(BEXAR CO.)

115P

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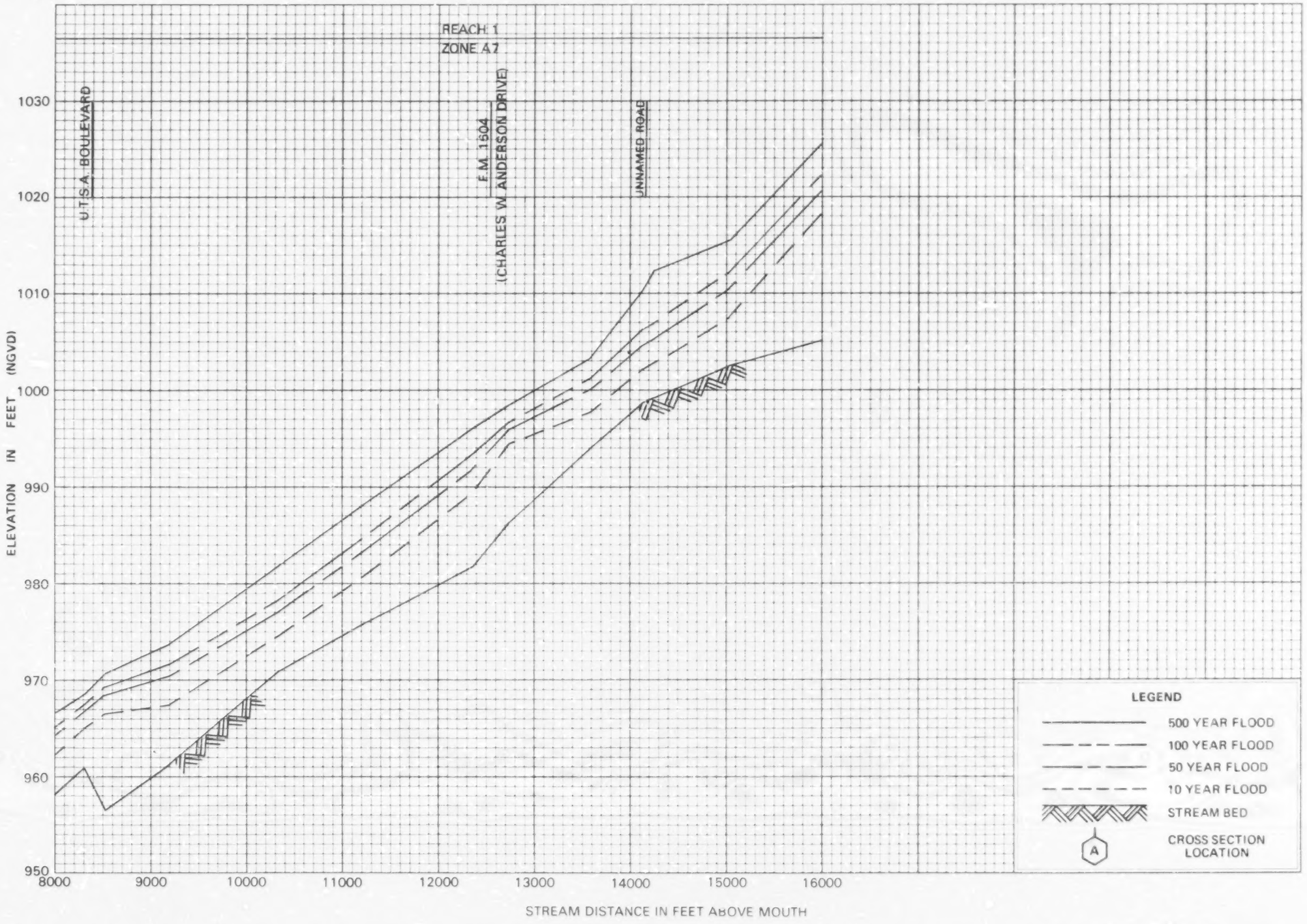

FLOOD PROFILES

BABCOCK TRIB.-LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

116P

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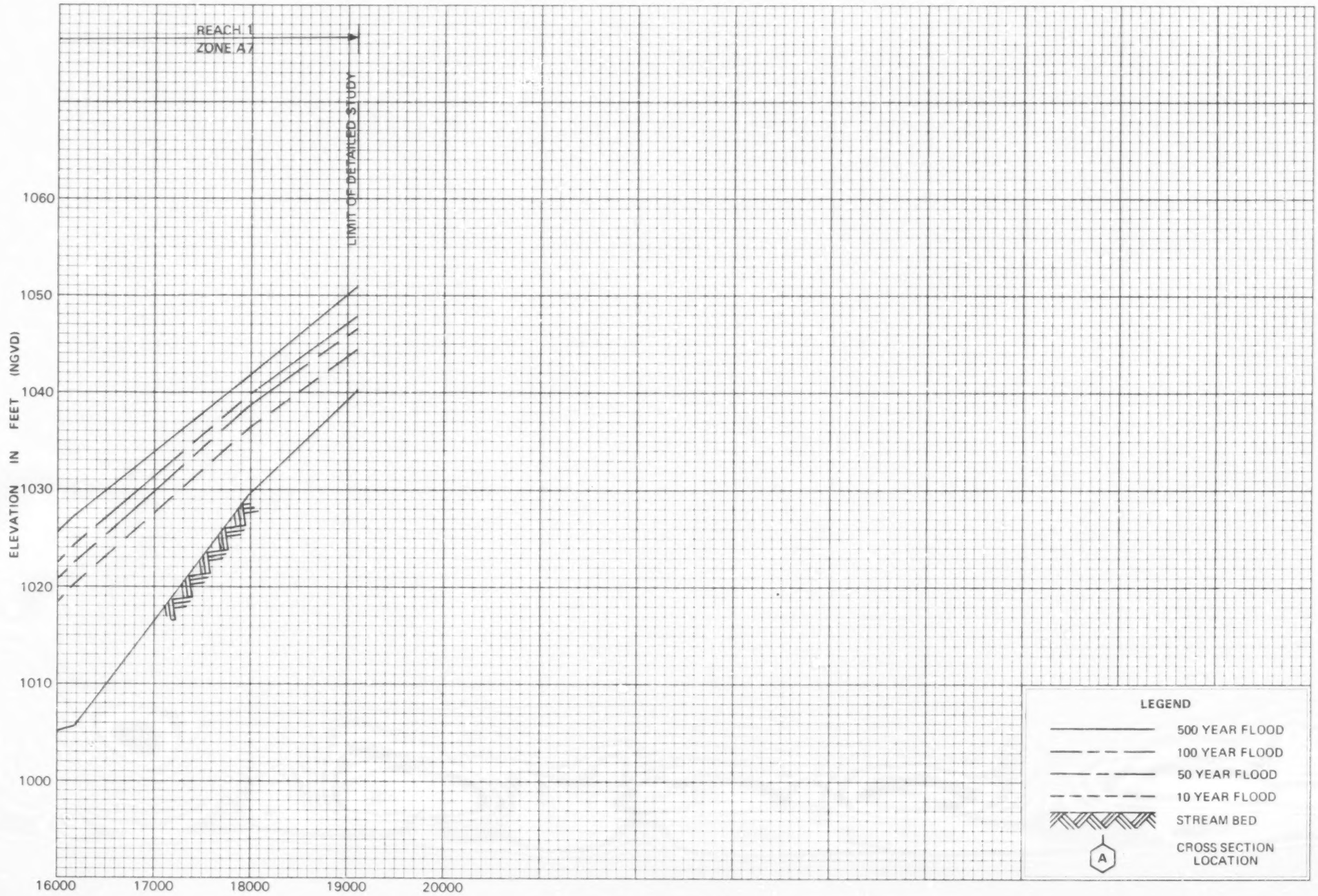

FLOOD PROFILES

BABCOCK TRIB.-LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

117P

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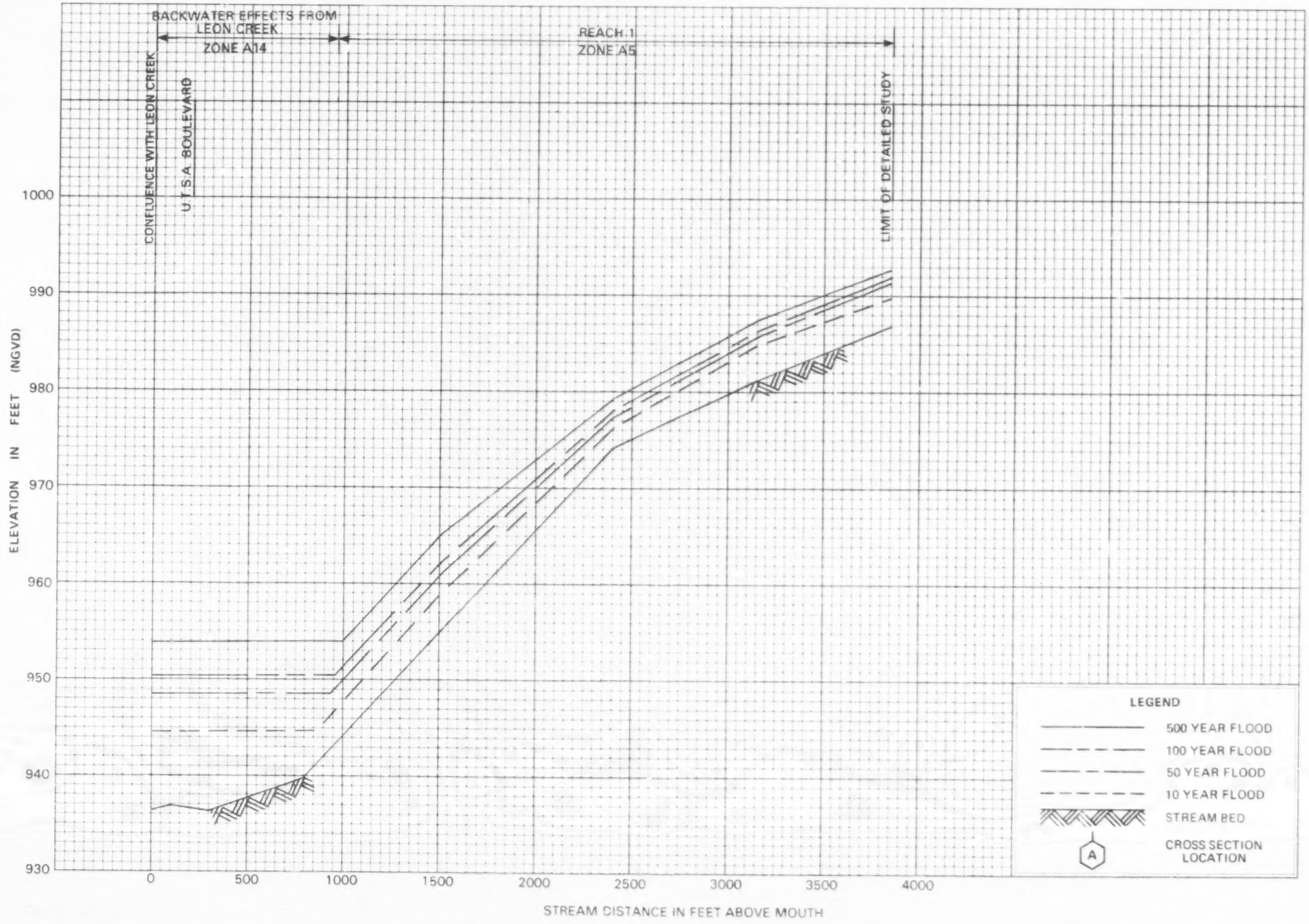

FLOOD PROFILES

U.T.S.A. TRIB.-LEON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

118P

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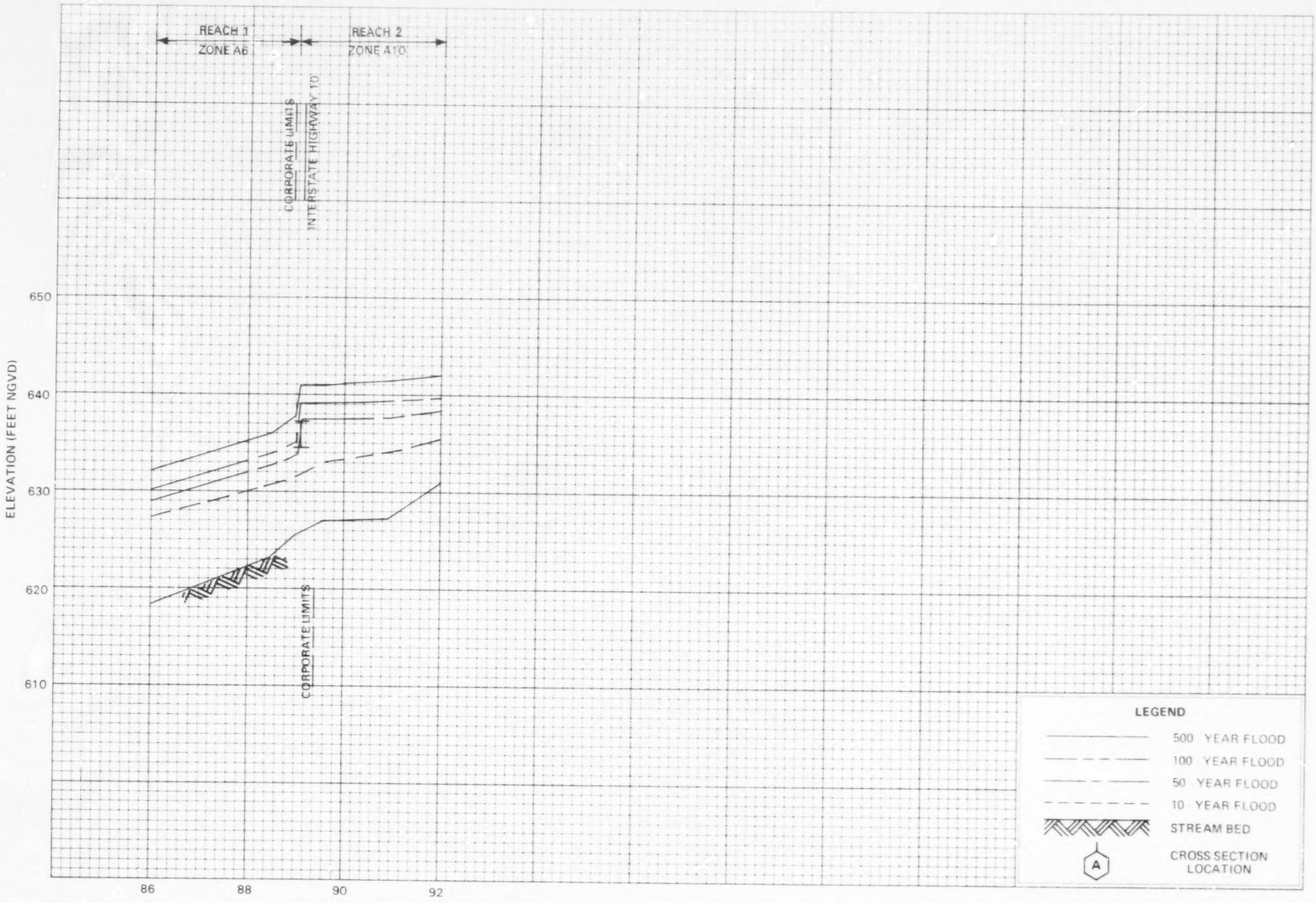

FLOOD PROFILES

MARTINEZ CREEK-BEXAR COUNTY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SAN ANTONIO, TX
(BEXAR CO.)

119P

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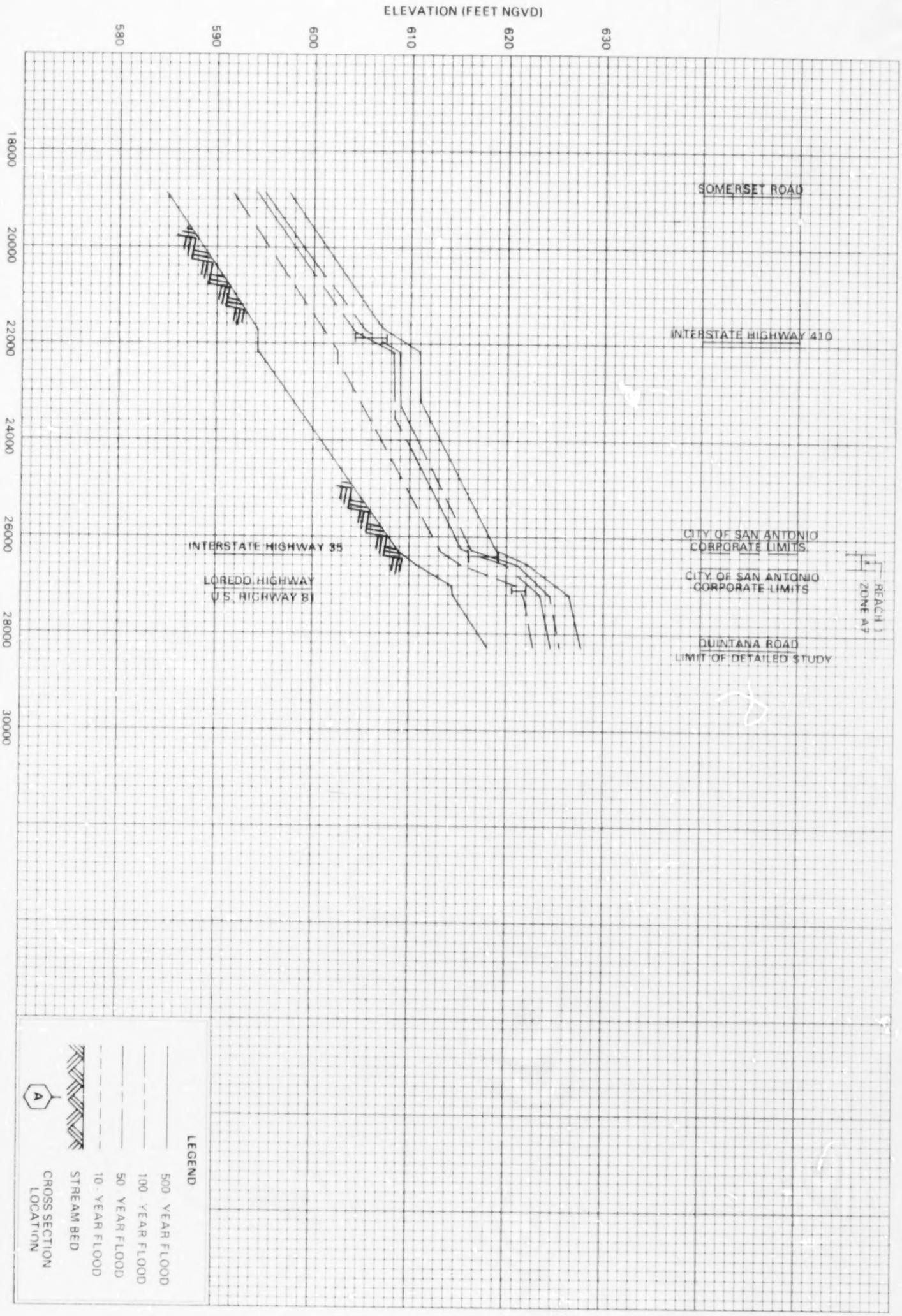

120P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF SAN ANTONIO, TX (BEXAR CO.)	FLOOD PROFILES INDIAN CREEK

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